[FOUNDED IN 1906 AS THE AMERICAN QUARTERLY OF ROENTGENOLOGY]

THE AMERICAN JOURNAL OF ROENTGENOLOGY

OFFICIAL ORGAN OF THE
AMERICAN ROENTGEN RAY SOCIETY

EDITOR

JAMES T. CASE, M. D. - - BATTLE CREEK, MICHIGAN

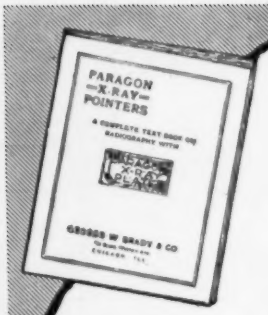
EDITORIAL BOARD

FREDERICK H. BAETJER, M. D. Baltimore
DAVID R. BOWEN, M. D. - Philadelphia
E. W. CALDWELL, M. D. - New York
R. D. CARMAN, M. D. - Rochester, Minn.
A. W. CRANE, M. D. - Kalamazoo, Mich.
SIR J. MACKENZIE DAVIDSON, M. B. - LONDON
A. W. GEORGE, M. D. - Boston
PRESTON M. HICKEY, M. D. - Detroit
G. E. PFAHLER, M. D. - Philadelphia
J. S. SHEARER, PH. D. - Ithaca, N. Y.
E. H. SKINNER, M. D. - Kansas City, Mo.

VOLUME IV NUMBER 11

November, 1917

PUBLISHED MONTHLY BY PAUL B. HOEBER
NEW YORK CITY



Come to X-Ray Headquarters

If you have any X-Ray problem—wish any information on X-Ray work—desire the very best X-Ray Plates and other material—come to X-Ray headquarters.

Gelatine Troubles Overcome

War conditions made trouble. But we have now solved the difficulties. New gelatine is meeting all requirements. Paragon X-Ray Plates are very fast, clean plates suitable for use with or without intensifying screen.

Ask for new price list of X-Ray supplies.

Get the new edition of PARAGON POINTERS—the last word in X-Ray technique. Sent free.

GEO. W. BRADY & CO. 761 South Western Avenue Chicago

PARAGON X-RAY PLATES

UNIVERSAL X-RAY PLATES

Speedy—Reliable

UNIVERSAL X-RAY PLATES

Universal X-Ray Plates have been speeded up particularly for use with intensifying screen, as well as in envelopes.

There are no better plates made at the price. The man who wants a plate at a moderate price will find Universal Plates highly satisfactory.

Ask for quotations.

Is your name on our list to get

THE X-RAY BULLETIN

regularly? It's Free.

GEO. W. BRADY & CO., 761 S. Western Ave., Chicago

THE AMERICAN JOURNAL OF ROENTGENOLOGY

Editor, James T. Case, M.D., Battle Creek, Mich.

VOL. IV (NEW SERIES) NOVEMBER, 1917 No. 11

MILITARY ROENTGENOLOGY

BY A MEMBER OF THE STAFF OF INSTRUCTION

IN the rush of army organization and development of military appliances, one might easily lose sight of the efforts of the medical branches of the service in behalf of those who must be injured.

The collection of medical supplies, the organization of immense hospitals, the training of a staff adequate for their operation and all for an army serving thousands of miles from our sources of supply, is a task calling for the highest talents and for most unselfish devotion to the cause. The army and its friends may well be thankful that this work has been in the hands of medical men of the highest rank, willing to coöperate in every way with all agencies working for the service of humanity.

Early last spring the matter of army *x*-ray facilities and personnel engaged the attention of the Surgeon General's office, and steps were taken to provide men and equipment capable of meeting the exigencies of the struggle. A committee on preparedness was appointed by Dr. L. G. Cole, then President of the American Roentgen Ray Society, to consider the matter, consisting of Doctors George W. Holmes, Leopold Jaches, Willis F. Manges and H. W. Van Allen. This committee, together with those of the New York and Philadelphia Societies and a large advisory committee in consultation with Lieutenant Colonel Huntington, U. S. Army, and Major A. C. Christie, M. R. C., undertook the work. They decided to organize proper instruction; make a canvass for suitable men; assist in the design of needed apparatus and secure a suitable manual for army work.

A conference was called for two weeks last June to consider what should be taught and to secure some degree of unity in the training. The roentgenologists who attended and who then took charge of instruction in their respective cities were Doctors Cole and LeWald of New York, Baetjer of Baltimore, Gray of Richmond, Manges of Philadelphia, George of Boston, Johnston of Pittsburgh, Blaine of Chicago, Skinner of Kansas City and Bowman of Los Angeles. Under their direction about two hundred men will have been instructed by December 15.

The various schools outside of New York City will have well served their purpose by that time, and the Surgeon General deemed it advisable to concentrate further work in New York. Between six hundred and eight hundred men will be needed in this service, and all must be given every possible advantage in a course of ten weeks' duration.

Along with this work new appliances

have been and are still being developed. Among these there is a complete new portable field outfit, using a "Delco" generator and a special air cooled Coolidge tube. A new bedside unit will soon be ready, having many unusual features. Under the direction of Capt. E. W. Caldwell of New York, a practical stereofluoroscope is rapidly nearing completion. Description of these new appliances may be given later.

Not the least gratifying element in this work has been the hearty coöperation of so many firms and individuals. The General Electric Company has given us new tubes suitable for continuous fluoroscopy. Five important manufacturers of *x*-ray apparatus have aided by development work and by the loan of apparatus of great value for instruction. Cornell University has given free use of space adequate to the work of the present and future School in New York. Many hospitals and clinics both in New York and where other schools are located, have freely given facilities for clinical work, pathologists, surgeons and engineers, busy to a degree scarcely appreciated by the public, have found time to render valuable aid in this field.

Among the contributors to the Army Manual are Lieut. Col. Huntington and Doctors Pfahler, Hickey, Manges, LeWald, Dunham, and Bowen. Last, but by no means least, there should be mentioned the loyal and effective coöperation of Major A. C. Christie, M.R.C., without which much less would have been possible of attainment.

That some mistakes have been made is inevitable, but these have been due to lack of time or experience rather than to lack of zeal. Surely when this reign of world terror is over, American roentgenologists may feel they have done what they could.

THE CALIPER METHOD OF FOREIGN-BODY LOCALIZATION

BY EDWARD S. BLAINE, M.D.

Captain, Medical Corps, U.S.R.; Instructor, Chicago School of Military Roentgenology; Roentgenologist, Cook County Hospital; Instructor in Roentgenology, Northwestern University Medical School; Fellow, Chicago Roentgen Society; Member, American Roentgen Ray Society, etc.

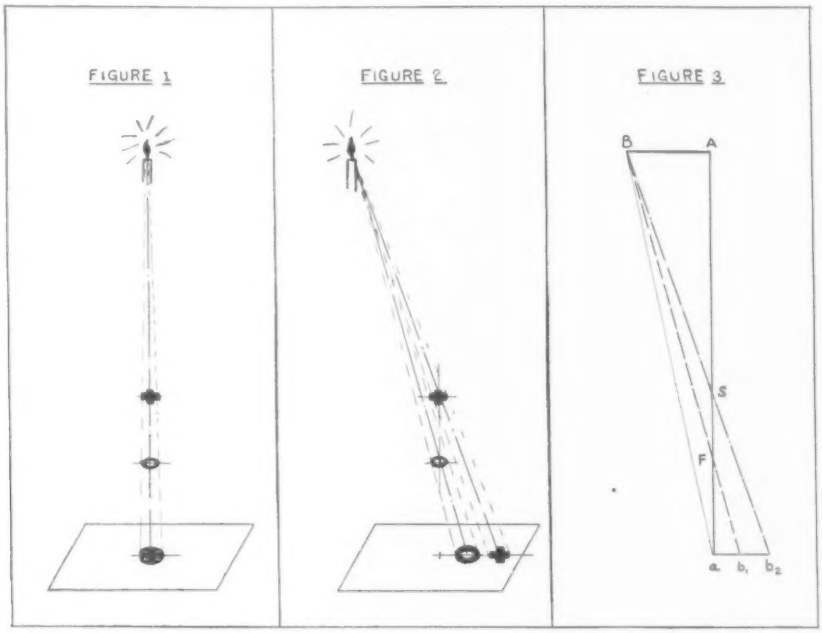
CHICAGO, ILL.

OF the numerous instruments devised and used in conjunction with the *x*-ray for the determination of the location of foreign bodies in the human tissues, the caliper of Fuerstenau is convenient and practical. It is not the simplest of the many localization methods but is not unduly complicated. Criticism may be offered because of the many chances of error that may occur, but when its limitations are realized and proper precautions are taken to avoid such errors, it will be found by the surgeon to be sufficiently accurate in the hands of careful roentgenologists for the successful removal of foreign bodies and will be regarded as a very serviceable method of localization.

This method of Fuerstenau is much in use in European countries, particularly in Germany where civil and military surgeons have been using it extensively both before and during the present war. An American model of this instrument is now available and the method has been recommended by the Committee on Preparedness of the American Roentgen Ray Society as one of the useful methods for this special work. The caliper method recently has been adopted by the Medical Department of the United States Army as one of the methods of foreign-body localization to be used by the Army Roentgenologists.

It is a method of geometric triangulation, a diagram of which is illustrated in Figures

1, 2 and 3. In Figure 1 is shown a source of light, set directly above a small metal cross, directly under which is a metal ring, all three being in a straight line over a flat surface at right angles to it. In this position of light, cross, ring and surface, the light will project the shadows of the cross and the ring on the flat surface, both shadows being superimposed. If this point be marked on the surface upon which the shadows are projected and the light be displaced laterally but at the same distance for the surface as in Figure 2, the shadows will be seen to separate, moving in a direction opposite to that taken by the light, and the cross shadow, which is farthest from the surface, will move the greater distance, that is, it will travel farther than the ring shadow. Combining these shadows formed by the beam of light striking the cross and the ring, we have several triangles as seen in Figure 3. As there is a certain definite relation between the movement of these shadows with the distances that they are from the surface and from the light in the two positions, the exact location of each can be determined from the amount of the shadow displacement. If we know the distance from the light to the plate and the amount of shifting of the light our problem is comparatively easy. If now we substitute a roentgen tube for the source of light and a roentgen plate for the surface upon which the shadows were projected and place a patient's body or limb containing a foreign body on the plate, and attach a metal cross on the skin over the foreign body, similar results will be obtained, and the location of the foreign body can be figured by the difference between the several shadows.



This method is figured and the caliper graduated for a distance of 60 centimeters from the target of the tube to the plane of the plate with a lateral shift of the tube of 65 millimeters. The graduated scales on the caliper are accurate only for these particular distances and are not applicable to shadows obtained at any other anode-plate or lateral-shift distances.

A small metal cross (furnished with the instrument) is used in this localization as a starting or "orientation" point. This cross is placed on the skin above the foreign body in close proximity to it.

The position of the cross is determined by a preliminary screen examination during which the foreign body is visualized, and, with the shutter narrowed to the smallest area possible to see the shadow of the foreign body, the cross is placed on the skin so that its shadow on the screen is just to one side, preferably at right angles to the long axis of the limb or body of the foreign-body shadow.

When the foreign body is long and thin, shift, but it will be found better to adopt a a certain way of performing the several steps of the localization to reduce chances of mistakes and errors. If the foreign body be not too small the cross may be placed directly over it, that is, in its shadow and thus no lateral computation will be necessary.

The limb or body is rotated under the screen in both directions at several angles to determine whether the foreign body lies in the anterior or the posterior half of the

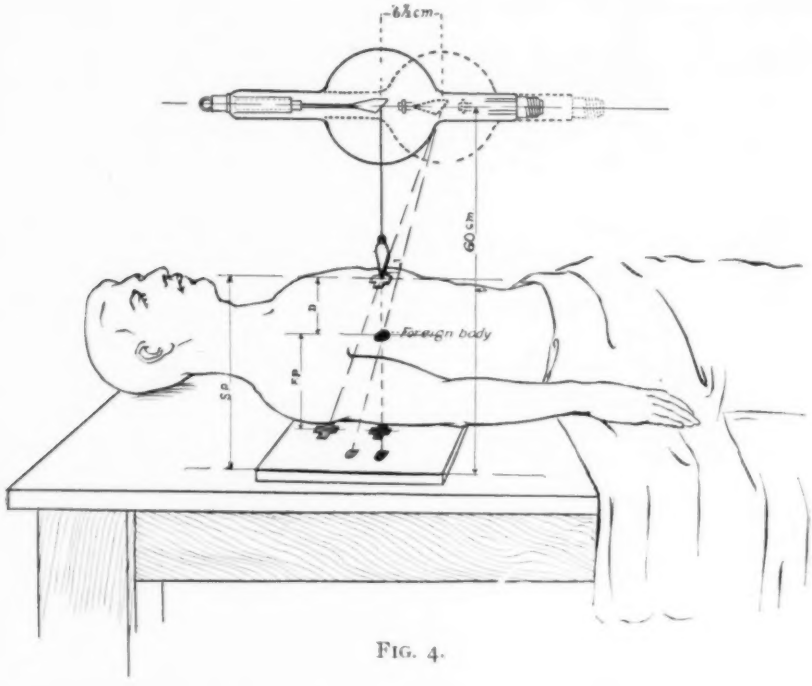


FIG. 4.

and lies parallel to the lon axis of the limb, as, for example, a needle, it is advisable to displace the tube *across* its long axis when the shift is made. This will make it easier to caliper the shadow displacement, because these shadows will then be separated whereas if the tube shift be along the long axis of the needle the shadows will be in line and the displacement cannot be easily distinguished.

Concerning the accuracy of the localization results, it is immaterial whether the tube displacement be toward the patient's feet or towards the head or across to left or to right, because the localization figures are equally accurate in any direction of tube part and the patient is so placed that the foreign body is in the upper half, that is, the position in which the surgeon will enter the tissues to reach the foreign body. Thus if the foreign body be found to lie posterior to the shaft of the femur, the patient is turned prone and the localization is made in this position; if in the anterior half, the supine position is used. When a fluoroscope is not available a preliminary roentgenogram is made of the part containing the foreign body which will reveal the foreign body shadow, and with this as a guide, the cross is placed close, though in a line laterally if possible, to the estimated position of the foreign body.

Having placed the metal cross on the skin (it may be held in place by a strip of adhesive plaster) the patient is kept on the roentgen table, with the limb, part or body in identically the same position as when fluoroscoped. This is of vital importance to the surgeon who can only under this condition find the foreign body at the point indicated by the roentgenologist's figures. A roentgen plate (usually 8 x 10 or 10 x 12) is placed under the part in which the foreign body lies so that the middle of the plate is approximately under the cross. The cross should be so placed that its arms indicate the long and transverse axes of the limb or body. Thus it will also indicate the line of tube shift. The position of the center of the cross is marked on the patient's skin with indelible material (silver nitrate stick) which will not be erased by pre-operative preparations. This is the "orientation point" for the surgeon. Then with the same material a straight line, about 5 cm. in length, is marked on the skin, starting from the orientation point, in the direction that the tube is to be shifted, preferably indicating the long axis of the limb or body. This is the "orientation line." A metal needle, furnished with the instrument, is placed on this line, and is inserted in that arm of the cross which is directed toward the patient's feet. The roentgen tube, having been previously centered in the tube holder, is accurately centered, with the aid of a small plumb-bob or other suitable means so that the perpendicular beam from the target will pass through the small hole in the center of the cross. (See Fig. 4.)

The success of foreign-body localizations by this method will depend partly upon the accuracy of centering the focal spot over the cross. It is imperative that the perpendicular beam of the roentgen ray be used, and this must be obtained by accurately placing the tube in the holder of the roentgenoscope as well as in the tube stand used in making the roentgenogram exposures. There are several methods of accomplishing this, which, however will not be discussed in this presentation. With the focal spot set exactly 60 centimeters from the plate, an exposure is made. If one uses a small diameter cylinder diaphragm, on the first exposure, which is just large enough to include an area of about 8 to 10 centimeters around the cross and foreign body, it will assist in roughly determining whether the tube diaphragm was properly centered over the cross. The use of such a diaphragm is not a necessity but a convenience. Before

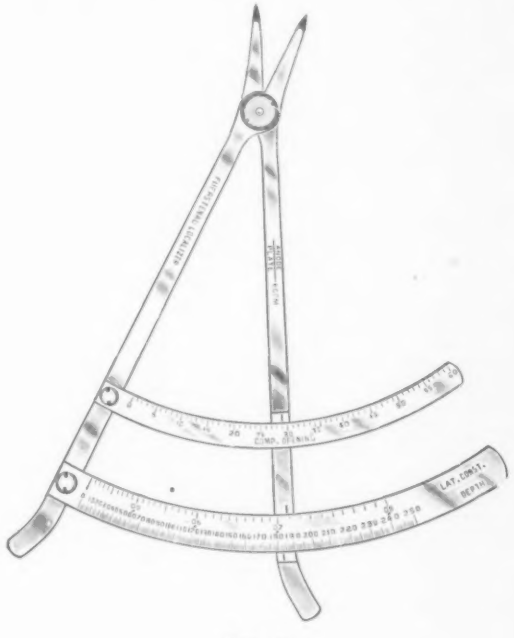


FIG. 5.

the second exposure (shift) is made, this narrow diaphragm must be removed in order to get the double shadows necessary for calibration.

After the exposure, the metal needle is removed (the cross being left in place) and the tube is displaced exactly 65 millimeters, usually towards the patient's feet but still at 60 centimeters from the plate, and a second exposure is made on the same plate. The metal cross may now be removed and the patient dismissed from the *x*-ray room.

The developed plate will be found to reveal double shadows of everything seen on the plate, excepting the indicator needle. The two cross shadows and two foreign-

body shadows are easily distinguishable in most cases. Under ordinary conditions localization is made after the emulsion on the plate has dried. When immediate localization is required, as is almost always the case in military and emergency surgery, the wet plate may be used, the calibrating being done on the glass side of the plate, though for greatest accuracy the film side is best, but is easily torn and injured by the caliper points. In this manner a complete localization may be made in about fifteen minutes.

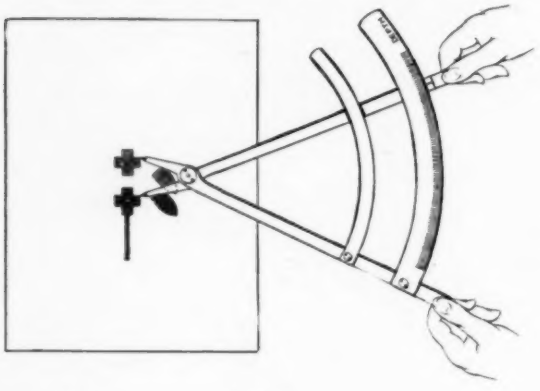


FIG. 6.

The caliper is a scissors-like instrument having two points and two side bars or arms on which are two arcs, the lower one being graduated with two scales, the upper with a single scale. These are, from below upward, (a) the "depth" scale, in millimeters, (b) "lateral constant" scale and (c) the "compass opening" scale. (See Fig. 5.)

To obtain the distance from the skin to the plate (that is the thickness of the part) the caliper points are placed on homologous points of the two cross shadows (Fig. 6) and the figure on the lowest scale is read at the indicator point and the figure noted. This is the distance (in millimeters) that the cross (skin) is from the plate. Then the caliper points are placed on homologous points of the two foreign-body shadows (Fig. 7) and the figure on the same scale (depth) is read and noted. This is the distance of the foreign body from the plate, that is, the under surface of the limb or body. To obtain the distance from the foreign body to the orientation point on the skin, subtract the two figures obtained on the two readings just noted. This is the depth of the foreign body from the skin.

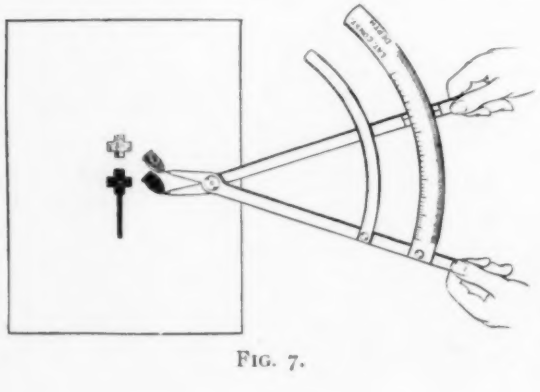


FIG. 7.

To obtain the lateral distance of the foreign body from the vertical center of the cross, the reading on the upper scale of the lower arc, "lateral constant," is noted when the caliper points are placed on homologous points of the two foreign-body shadows (Fig. 7). Note that this scale reads from right to left. Then one of the caliper points is placed on the center of the cross shadow and the other point on the center of the lower foreign-body shadow made on the first exposure (Fig. 8) (the lower pair of shadows, if the shift was made toward the patient's feet), and the reading on the scale on the upper arc, "compass opening," is noted. The two figures thus obtained are multiplied and the result is the lateral distance, in millimeters

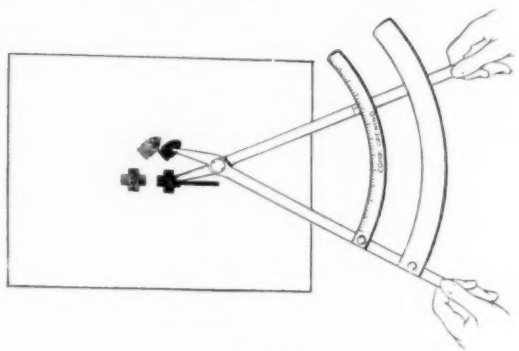


FIG. 8.

of the foreign body from the point marked on the skin, the orientation point, which indicates the position occupied by the cross during the exposures. A line is drawn on the film surface of the plate between the center of the cross with the needle shadow which is in line with the needle and the foreign-body shadow made on the first exposure. The angle formed by this line and the shadow of the needle is measured with an angle indicator or protractor (Fig. 9). Before surgical operation this angle can now be transferred to the patient's skin, the orientation line previously marked on the skin forming one arm of the angle. The second arm of the angle must be in the same relation to the orientation line as is the line drawn through cross and foreign-body shadows on the plate. The foreign body will lie directly beneath the point figured for the lateral distance on the line just added. This angle may be given in degrees of a half circle, from zero to 180°, specifying "right" or "left" to denote which side of the "orientation line" the foreign body lies, zero the lowest point toward the patient's feet. If the needle and orientation line be not used, as in the earlier model of this method, it will be necessary to describe to the surgeon the direction that the foreign body lies with relation to the orientation point. If the tube shift be always in line with the long axis of the body and toward the patient's feet, this may be given in degrees of a circle, as above described, or one may use the clock figures as is done in microscopic field descriptions. As, for example, the foreign body lies "lateral 3 cm. at 5 o'clock."

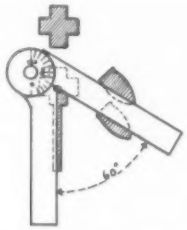


FIG. 9. SCALE OF DIAGRAM ENLARGED TO ILLUSTRATE MORE CLEARLY THE FINDING OF THE ANGLE.

An instrument has been devised by Wesky which, when set at the angle and lateral displacement figures obtained with this caliper will indicate the point on the skin under which the foreign body lies. This instrument is not available at present.

While this caliper method is essentially a combined screen-plate method, it can be used with the screen alone in case of necessity as for instance when plates are not at hand, or where a developing room and supplies are not available. Using the caliper to measure the shadow displacement on the screen is quite similar to the methods of Thurston-Holland, Moritz and others, all of which are based on the same fundamentals, but each one varying in some detail as to distance used, scales, etc.

To obtain accuracy with the caliper on the screen it will be necessary to observe identical conditions of tube-centering, anode-screen distance, tube shift, etc., as in using plates. The screen is placed horizontally upon a support which holds it parallel to the tube-box travel. This support is best a four leg frame, the length of the legs being such that the distance between the focal spot and the screen (not the glass covering) is exactly 60 centimeters. The legs rest on the table top on either side of the patient's body. An arrangement whereby the tube-box travel is limited to exactly 65 millimeters is convenient. To aid the roentgenologist in setting the caliper point on the glass surface covering the screen, one may cut a 4- or 5-centimeter cross in the middle of its area, the arms being parallel with the sides and ends of the screen holder frame. After centering the shadow of the foreign body on the transverse cross line, place a metal cross or other opaque marker upon the skin in line with the foreign-body shadow; then set the stop-travel at one end of same and shift the tube-box to the limit of travel, that is, 65 millimeters. Place one caliper point on the line (this indicates the perpendicular beam on first observation) and the other point on the cross shadow and note the reading on the depth scale; then place the same caliper point on the

foreign-body shadow and note the reading on the same scale. Subtract these two readings and the difference will be the distance between the skin and the foreign body. It will be seen that no lateral computation is needed as the foreign body lies directly below the cross, the position of which is marked on the skin with indelible material before it is removed. With the patient's body or limb in the identical position on the operating table as on the roentgen table the surgeon should find the foreign body at the point indicated by this localization. This point is vertically under the spot marked on the skin, at right angles to the surface of the table on which the patient lies.

In their recent work on "Foreign body Localization," Freund and Praetorius dwell at length on the Fuerstenau caliper method stating its good points, and in addition they set forth numerous sources of error that may occur. They accord it, however, a high place among the practical methods available.

It is seen that the depth of a foreign body is easily obtained by this caliper method but the lateral distance involves considerable care, mathematical calculation and is less convenient. The errors that are liable to creep in when so many steps are to be taken will be minimized according to the skill and care of the roentgenologist. If the surgeon will coöperate with his roentgenologist, this method will, through close team work, be found to afford a high percentage of successful foreign-body removals.

THE MILITARY AND NAVAL USE OF THE ROENTGEN RAY *

BY ALBERT SOILAND, M.D., F.A.C.P.

Professor Roentgenology, College of Physicians and Surgeons, University of Southern California. Asst. Surgeon, M.R.C., United States Navy.

LOS ANGELES, CALIF.

THE exigencies of modern warfare as viewed from a medical aspect have developed the fact that roentgenology is one of the most important of the surgical specialties, and also that there is a deplorable lack of both men and equipment to successfully prosecute the work to its fullest extent. To meet this condition a number of America's most distinguished roentgenologists have organized a teaching staff with the full approval and coöperation of army medical chiefs. Their duty will be to teach practical roentgenology to officers of the army medical reserve corps, and they are now hard at work perfecting the organization and securing recruits and equipment. The Navy will probably follow this example but on a smaller scale, owing to the fact that the use of the roentgen ray in marine service is limited.[1]

There are many angles from which to view the matter of roentgen service in warfare. During the early part of the present war, when in Europe, I had an opportunity to observe some of the medical preparations and viewed with some trepidation the roentgenological field equipment going into commission. In many instances, I noted the old induction coil, the mechanical break, the heavy storage batteries, and worst of all the old box fluoroscope which men were expected to use who already bore marks of roentgen injuries. However, some of the hospital units had more modern appliances and provision was made for the protection of the operators. Most happily, American engineers have perfected the apparatus for practical service in the present crisis, and at the same time ensured much more protection to the men who are now going to accompany the Stars and Stripes into foreign fields. Even with these mod-

[1]Medical Officers of the Navy may enter the School of Military Roentgenology, Cornell Medical College, New York City, on request of the Surgeon General of the Navy.

*Read at the midsummer meeting of the Pacific Coast Roentgen Ray Society, Avalon, Catalina Island, July 20 and 21, 1917.

ern instruments, however, the danger of roentgen effects to the operator is by no means negligible, a fact which it would be well for the military teacher of roentgenology to forcibly impress upon the minds of the officer students.

In busy base or field hospitals, the major fluoroscopic work should be detailed to junior medical officers who as yet bear no roentgen scars. In active service the roentgenologist will be called upon to deliver to the surgical staff, quickly and correctly, the nature and extent of certain injuries that are amenable to roentgen investigation. Of these, gun shot wounds and fractures will predominate. Information is demanded as to the number, size, and location of bullets, shell fragments, and foreign bodies, together with the condition of military fractures of every conceivable kind. Whenever expedient and in order to save the operator as much as possible, the information sought in this class of work should be obtained from the negative. Where speed is essential and it is desirable to operate quickly, it will be necessary to use the screen. There are a number of rapid and accurate localization technics, both by screen and plate, based mostly upon the McKenzie Davidson cross thread method, and no doubt the roentgen instructors will centralize upon one or several that are best adapted for the work.

It seems singular that nowhere in the army or navy literature has any reference been made to the possibility of using roentgenology as a therapeutic measure. It would seem that nowhere could the diversified action of the rays be used to better advantage than in the enormous number of sluggish wounds with every conceivable degree of infection, injury, and slow repair. I am certain that their intelligent application in suitable cases would materially shorten the period of healing and save the patients a great deal of time and suffering. The time saved alone would be of great economic value to the government.

Having enlisted in the medical reserve corps of the Navy as a roentgenologist two years before America entered the war, I was in due course of time commissioned Assistant Surgeon in this department. Since then I visited several navy hospitals in an unofficial manner for the purpose of ascertaining to what extent the roentgen ray was employed, and it was quite apparent that this branch of medical science then existed largely in name only and that very little effort had been made to keep this department on a plane with other modern medical and surgical development. Some of the apparatus seen was of old design, and even in those hospitals where more expensive paraphernalia were found, it was noticed that the operator or technician was not trained in accordance with the present military requirements. I have on various occasions suggested to the Bureau of Medicine and Surgery of the Navy that some means be adopted by the Board to standardize roentgenological equipment in all navy hospitals and ships, and to provide for some means of teaching modern technic, to the officers in charge of the Roentgen Service, as we now see done in our schools of military roentgenology.

It seems appropriate at this time during the meeting of the society of representative roentgenologists of the Western States of America that this subject of military roentgenology, both for the army and navy, should be discussed, and the fruits of its labors be compiled and made serviceable to our government. Perhaps when the proper medical chiefs or authorities realize that the up-to-date roentgenologist is not only a skilled technician, but also a surgical pathologist, internist, and a diagnostician of no mean ability, the spirit of combativeness which often meets our efforts to serve our country and fellow men will be dispelled, and the science of roentgenology which is so well represented in this Society will be placed upon the high professional plane it deserves.

ROENTGEN DIAGNOSIS OF CONCURRENT GASTRIC AND DUODENAL ULCER

RUSSELL D. CARMAN, M.D.

Mayo Clinic,

ROCHESTER, MINN.

THE object of this paper is to call attention to the frequent concurrence of gastric and duodenal ulcer and the possibility of discovering both conditions in a given instance with the roentgen ray.

In the Mayo Clinic, during the year of 1916, sixteen patients were found at operation to have both gastric and duodenal ulcers. In the same year the total number of cases of gastric ulcer in which operation was performed was 139, and the total number of cases of duodenal ulcer was 490. In other words, 11.5 per cent. of the patients having gastric ulcers had duodenal ulcers also, and 3.2 per cent. of the patients with duodenal ulcer had associated gastric ulcers. The diagnosis of these lesions, when they coexist, is therefore of some practical moment.

A purely clinical diagnosis, or rather a diagnosis independent of roentgen assistance, is obviously not feasible. Even when either condition exists alone, the clinical differentiation between them is often impossible, and the roentgen ray is commonly utilized as an aid. Likewise, when both lesions are present we are usually obliged to depend on the roentgen examination to establish the fact.

The 16 patients mentioned were all examined by the roentgen ray. Frank admission must be made that in only 7 of these was the presence of both lesions discovered by the roentgen examination. However, for reasons that will be set forth, it is probable that this small number does not fairly represent the limits of efficiency of the roentgen method. In 2 cases diagnoses of gastric ulcer alone were made, in 6 cases of duodenal ulcer alone, and in 1 case the diagnosis was gastric cancer. Thus in all of the 16 cases, there were roentgen signs of a pathological condition, and with the one exception correct diagnoses were made either wholly or in part.

The roentgen signs of gastric and duodenal ulcer include phenomena peculiar to one or the other condition, and manifesta-

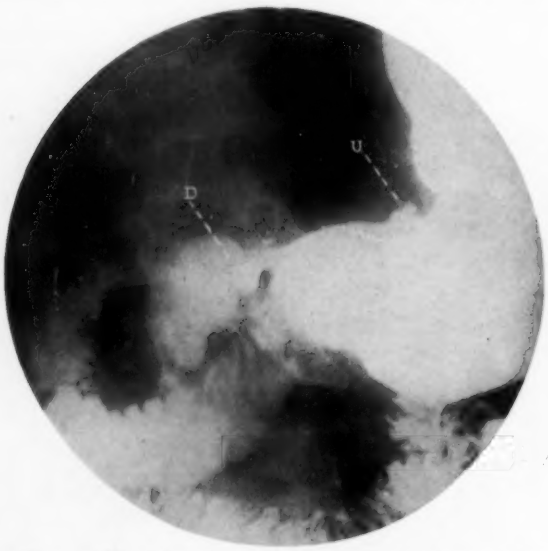


FIG. 1. U, niche of gastric ulcer. D, duodenum with bulbar deformity.

FIG. 2. U, crater of gastric ulcer. D, duodenum, showing spastic deformity on lesser curvature side of bulb.

tions which are common to both. Either definite and constant bulbar deformity or the combination of gastric hyperperistalsis with a six-hour retention are safely diag-

FIG. 3

nostic of duodenal ulcer, while a niche or accessory pocket is pathognomonic of gastric ulcer. When such definite signs of both lesions are present, the observer has himself only to blame if his diagnosis is incomplete. However, unless a careful examination is made routinely of both stomach and duodenum he is likely to be satisfied with the discovery of the gastric ulcer alone, or the duodenal ulcer alone, in the same way that surgeons sometimes limit their attention to a single diseased organ and overlook others.

In those cases in which only a half diagnosis is made there is a fair percentage in which definite signs of one or the other condition are lacking. Occasionally a duodenal ulcer may exist in spite of a normal bulbar contour. A shallow gastric ulcer of the mucous type may not give rise to a visible niche. A niche on the posterior wall, especially if high up toward the cardia, may elude observation. In such cases the only discoverable roentgen evidence may be a six-hour retention or spastic phenomena such as hour-glass stomach, incisura or regional gastric spasm. It is particularly unfortunate that any or all of these manifestations may occur with duodenal ulcer solely. Further, in such instances the spasm tends to persist even after the administration of belladonna, although this test ordinarily suffices to exclude extrinsic gastrospasm. Thus, given a case of duodenal ulcer, recognizable by constant cap deformity, and some form of gastrospasm which resists antispasmodics, the examiner cannot determine whether or not a gastric ulcer is also present.

On the other hand, when the presence of a gastric ulcer has been established, it is sometimes difficult to fill the duodenum sufficiently to determine a bulbar deformity which is indicative of duodenal ulcer. Because of the hyperacidity commonly incident to gastric ulcer or for some other reason, the pylorus may tend to remain spastically contracted during the time of examination, and even by manipulation it may be hard to express a sufficient volume of the opaque meal into the duodenum to outline its contour. Even when the pylo-

FIG. 4

rus is free, it is not easy to distend and visualize a capacious duodenum, which fills only partially and then empties as fast as the additional contents come in. In such a case the only bulbar distortion may be a small spastic deformity, and unless the

duodenum is fully outlined the deformity will not be recognized.

Notwithstanding these handicaps, the roentgenologist should keep in mind the possibility of gastric and duodenal ulcer and give a complete examination in every case. Following are histories:

CASE I. A man, aged 54 years, with a thirty-five year history of stomach trouble, had two or three attacks yearly, lasting from two weeks to two months, and worse in the autumn. The attacks consisted of epigastric pain coming on two or three hours after the meal and lasting until food was taken, which always gave relief. Besides this pain, he had sour stomach, gas, belching, nausea and vomiting of bitter sour material. Attacks might be precipitated by eating apples, cabbage or acid food. Four weeks previous to examination he had a hemorrhage with blood both in the vomitus and the stool. Normal weight 165 pounds; at the time of examination, 155. Gastric analysis: Total acidity 78; free

FIG. 5

hydrochloric acid 68; combined 10; no food remnants. Hemoglobin 66 per cent.

Roentgen Findings.—Retention of one-fourth of the six-hour meal. Bulbar deformity. Niche on the lesser curvature (Fig. 1). Diagnosis: Duodenal ulcer; gastric ulcer.

Findings at Operation.—Ulcer on the lesser curvature; ulcer of the duodenum ½ inch below the pylorus.

CASE II. The second case was that of a

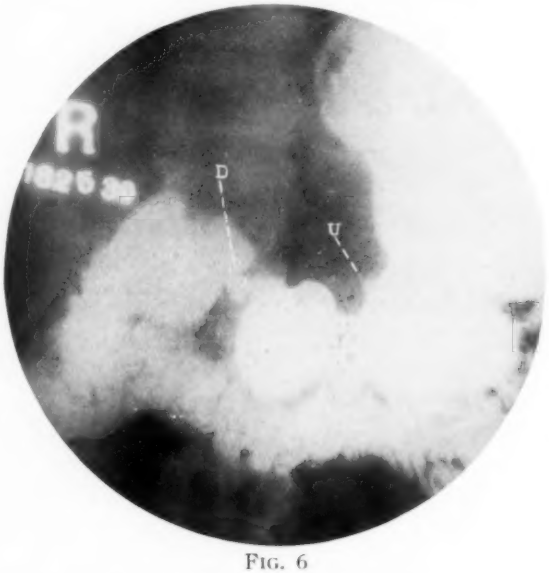


FIG. 6

man aged 44 years, who since young manhood had had attacks of pain in the left hypochondrium three hours after meals which was relieved by food, soda or hot applications. He was often awakened at 3 or 4 A. M. by the pain. Intermission between attacks might last from two to four weeks. On three occasions, at the age of 21, 25 and 35 years, he had hemorrhage by mouth. Four years ago blood was noted in the stool. For three or four years there had been frequent vomiting of sour colorless fluid. Loss of weight, 8 pounds during the past year. Hemoglobin 75. Gastric analysis: Total acidity 60; free hydrochloric acid 50; combined 10; no food remnants; blood 3.

Roentgen Findings.—Retention of one-fourth of the six-hour meal; niche on the lesser curvature; bulbar deformity (Fig. 2). Diagnosis: Gastric ulcer; duodenal ulcer.

Findings at Operation.—Large ulcer on lesser curvature 3 inches above the pylorus, perforating into the pancreas; ulcer of duodenum one-half inch below the pylorus.

Roentgenograms of similar cases are shown in Figures 3, 4, 5 and 6. U marks the crater of the gastric ulcer, while the deformity of the duodenal bulb is seen at D.

ROENTGEN OBSERVATIONS OF THE PITUITARY REGION IN INTRACRANIAL LESIONS

BY GEORGE C. JOHNSTON, M.D.

Major, M.R.C., U. S. Army; Professor of Roentgenology, University of Pittsburgh; Roentgenologist to Allegheny General, Presbyterian, Eye and Ear, St. John's, Children's, Magee, Mercy and Passavant Hospitals.

PITTSBURGH, PA.

A DIAGNOSIS of the character of intracranial lesions and the location of the lesions, when diagnosed, are two of the most difficult feats of modern medicine and, to be successfully and accurately performed, will call for the collaboration of the roentgenologist, ophthalmologist, internist, neurologist, and surgeon. While it may be possible for any one of these specialists to accurately diagnose such conditions in isolated instances, it is the part of wisdom to bring their combined knowledge and experience to bear upon each individual case, if failure is to be avoided.

In dealing with the recognizable changes produced in the region of the pituitary fossa by the various types of intracranial pathology I may, since the subjects are so closely correlated, include various other changes induced in the interior of the cranium by the types of pathology other than pituitary, which may produce secondary changes in the region of the sella turcica by external pressure, etc. This will provide for the consideration of the following points:

I.—A normal roentgen image of the sella, the anterior fossa, internal auditory meatus, the grooves on the interior of the skull for the various blood vessels and the normal appearance of the sutures.

II.—Permissible variations in type of the sella with variations in size, shape and contour of the clinoidal processes.

III.—Changes in the region of the sella and in the base of the skull occurring in certain types of so-called idiopathic epilepsy.

IV.—Changes due to acromegaly.

V.—Changes produced in the region of the sella by pituitary struma.

VI.—Changes produced by the presence of tumors of the anterior fossa and those arising above and behind the sella.

VII.—The earliest possible roentgen evidence of internal hydrocephalus.

VIII.—Brain tumors.

IX.—Technic of roentgenography of the sella.

I.—In taking up these points in their order, it will be conceded that any attempt to describe the roentgen image of a normal skull is a rather large task, a true conception of the normal as compared to the permissible variations being possible only by careful study of many hundred lateral roentgenograms of the skull made for some other purpose than the localization of pituitary or other intracranial lesions. This having been done, however, the observer subconsciously acquires a standard, which to him represents a normal and which takes into consideration at least the following factors:

DATA DETERMINING NORMAL

(1) The size, general outline and contour of the skull.

(2) The condition of the sutures, whether closed or forced open.

(3) The thickness of the internal and external tables of the skull.

(4) The size of the frontal and sphenoidal sinuses.

(5) The size of the pituitary fossa and the degree of prominence of the anterior and posterior clinoidal processes.

FIG. 1.

(6) The thickness of the floor of the anterior fossa.

(7) The condition of the internal auditory meatus.

(8) The amount of grooving of the skull for the internal blood vessels. Pressure effects of accessory vessels.

(9) The presence or absence of the characteristic markings of internal hydrocephalus, which will later be described.

II.—All these factors contribute to the formation of a conception of the normal or abnormal roentgen image. In the consideration of the type variations of the sella, our attention should first be directed to the size. The average size is about 12 millimeters transversely, 5 millimeters from above downward and 7 millimeters in the sagittal direction. There are, however, wide variations in size which still remain within apparently normal limits. Too much attention has been paid, as a rule, to enlargement and pathology of the sella at the expense of the relation existing between a very small sella and an exaggerated condition of disease of the ductless glands. Moreover, it seems desirable that some conception, even though very elastic, be adopted as the limit to normal variation in the size, shape and position of the clinoidal processes. Once such a conception has been formulated it is safe to construe any decided deviation therefrom as presumably a result of intracranial pathology. A study of a few lantern slides of the various types of pituitary fossæ, will convince you that it is well to have seen a large number of excellent roentgenograms of the head before adopting any mental standpoint, as to the normal condition, and decreeing any deviation therefrom as pathological.

Nature has placed the pituitary gland in one of the most inaccessible portions of the body, carefully protecting it by a bony pocket which almost completely

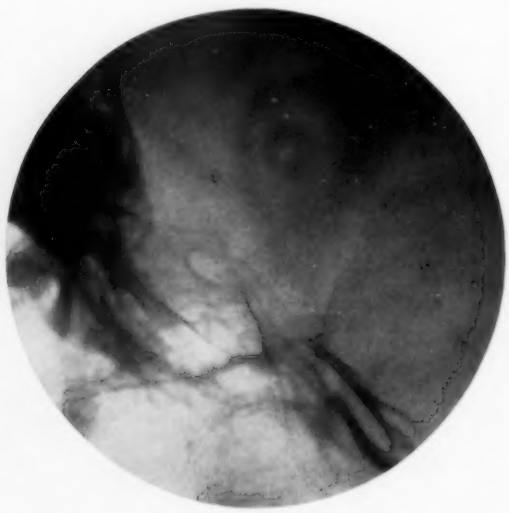


FIG. 2. SELLA IN DIABETES INSIPIDUS.

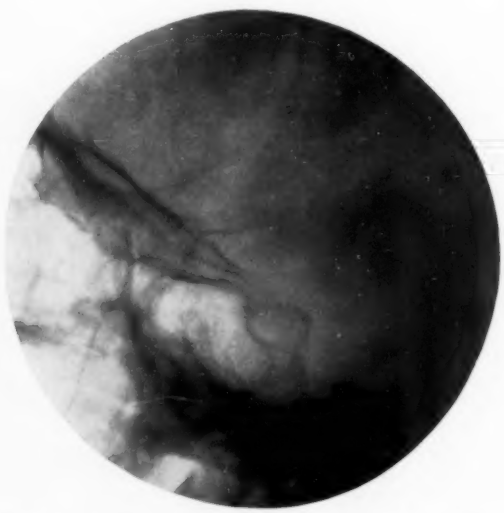


FIG. 3. CHANGES IN SELLA SHOWN IN DIABETES INSIPIDUS.

envelops it. Any marked variations in functional activity or any cystic enlargement or tumor (usually adenoma or adenocarcinoma), must necessarily cause destructive changes which are recognized roentgenographically in the contour or opacity of these surrounding bony walls. The floor of this pocket is also the roof of the sphenoidal sinus. Tightly stretched like a canopy between the clinoidal processes and across the bed of the pituitary gland there is a prolongation of the dura, perforated in the center for the infundibulum. It is the fortunate existence of this canopy that permits of an early diagnosis of pituitary struma, since it holds the pituitary in its bed.

In the study of every possible pituitary lesion it is necessary to observe the general degree of ossification of the base of the anterior fossa in order to actually estimate whether or not there is a pressure atrophy of the base of the sella and of the roof of the sphenoidal sinus. If the floor of the anterior fossa be quite thick, the roof of the orbits heavily ossified, the posterior walls of the frontal sinuses thick and opaque and the floor of the sella very thin, we are quite justified in presuming that the floor is undergoing a pressure atrophy, even though the gland be not enlarged and the clinoids have as yet undergone little, if any, change in size, shape, position or density.

III.—About four years ago, the author, in association with Dr. T. M. T. McKennan of Pittsburgh, called attention to certain rather constant variations occurring about the sella turcica and the anterior fossa of the skull in cases of so-called idiopathic epilepsy, these changes consisting of a more or less marked hyperostosis that involved the clinoidal processes, the base of the anterior fossa and in some instances the post-clinoidal region. In some of the cases examined this process, which we then described as a local acromegaly, had progressed to such an extent that the anterior and posterior clinoidal processes seemed to meet, with the consequence that the pituitary fossa itself was apparently encroached upon to a considerable degree. These findings have been confirmed by various observers but no further light has been thrown upon the subject. Since that time a large number of additional cases have been examined, and the reports appear with rather constant regularity.

Schueller in his new work calls attention to the localized thickening at the base of the skull, involving also the frontal floor, in cases of epilepsy. He, however, gives no credit to the author's investigations along this line, although he was present at the meeting when these investigations were announced.

FIG. 4.

IV.—In most cases of acromegaly, one of the manifestations of hyperpituitarism, there occurs a very considerable hypertrophy of the pituitary itself, leading to a marked enlargement of the sella turcica and sometimes giving symptoms of brain pressure. In many of these cases the effect upon the pituitary fossa is precisely

he same as in incipient pituitary struma; ut the hyperostosis of the bones of the ace, the increase in size of the sinuses,

FIG. 5.

closing of the sutures, the development of the external occipital protuberance, etc., are usually sufficient to make the roentgenological diagnosis. The internist, in addition, recognizes the condition as one of hyper- rather than hypopituitarism.

V.—The changes produced in the region of the sella by pituitary struma were noted as early as 1889, when Oppenheim (1) observed the destruction of the post-clinoid

FIG. 6.

processes of the sella turcica in a patient of his, deducing therefrom the existence of a tumor of the hypophysis which was later verified by operation. Erdheim (2), Kohler (3), Jaugeas (4), Fuchs (5) had also done excellent work along this line a number of years ago. In this country a great part of the work upon the pituitary from the roentgenological standpoint has been performed by Drs. Baetjer and Waters in the service of Johns Hopkins Hospital, while the work of Cushing, of Harvard, and that of Falta, of Vienna, is

FIG. 7.

of course familiar to all of us, the latter through Meyer's translation.

The evidence of change in the region of the pituitary may be accepted as diagnostic of the existence of pituitary struma, but it is not a fixed quantity and far from uniform in any series of cases. The roentgen evidence but rarely depends upon the visualization of the tumor as such; it never does, unless the diseased pituitary has undergone changes, such as calcification or fibrosis. It rather depends upon the deformation and pressure absorption or

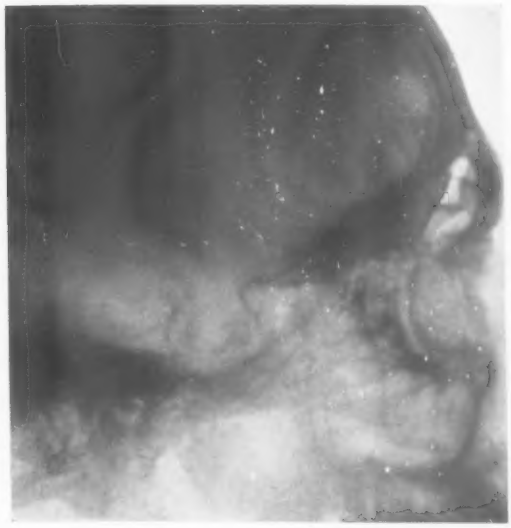


FIG. 8.

atrophy of the clinoidal processes and of the roof of the sphenoidal sinus.

If the pituitary has undergone a cystic degeneration, the posterior clinoidal process may be merely forced backward, increasing the introitus; and if it were not for the heavy dural roof mentioned above, cystic degeneration of the hypophysis might give rise to no roentgen evidence whatever, and a diagnosis could only be made from the existence of a bitemporal hemianopsia.

In adenocarcinoma of the gland the tumor growth is frequently downward, the roof of the sinus is destroyed, and the growth invades the sinus itself, while but little effect is shown upon the processes, and pressure on the chiasm may be almost entirely avoided. Hence but little effect may be shown on the ocular fundus or visual field.

When the clinoidal processes are very heavy, the gland may be expected to enlarge at the expense of the roof of the sphenoid, but where the processes are rudimentary, enlargement is prone to occur upward and backward. As the process advances, the pressure atrophy of the bony landmarks in the region of the sella progresses rapidly, until it may be almost impossible to obtain a roentgenogram which more than faintly indicates the outline of the deformed sella. This of itself is evidence of pituitary struma, just as the impossibility of obtaining roentgenographic details in a tubercular wrist is of itself rather diagnostic of the disease. If the pressure be manifested forward due to very heavy posterior clinoids, early changes in the visual field may be expected to occur, whereas if the pressure be manifested backward, exaggerated posterior lobe conditions with the resulting epilepsy, carbohydrate intolerance, adiposa feminalis, absence of libido, etc., may be expected to follow.

Visualization of the tumor itself is not so rare as the search of the literature may lead one to expect. Heuer and Dandy (6) state that we have in the literature less than twenty recorded instances, but I am inclined to believe that this is due to the failure of observers to record such

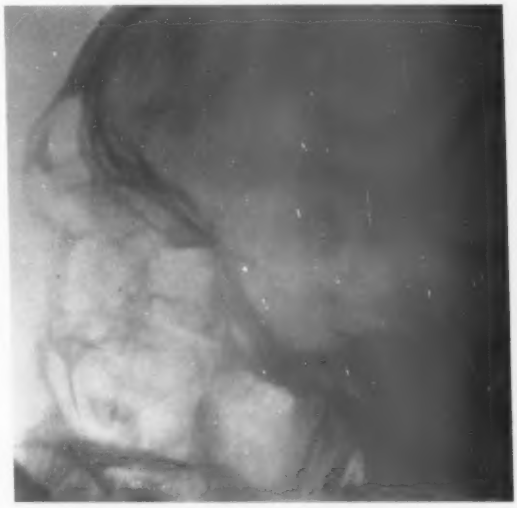


FIG. 9.

occurrences rather than to the rarity of the condition. Calcification of the pineal gland is, of course, a common observation and ceases to attract attention. I have personally observed two cases of calcification of the hypophysis, one of calcified aneurysm and one of calcification of a basal tumor of unknown origin. For a

further study of this portion of the subject attention is called to the excellent article by Heuer and Dandy with roentgenograms by Baetjer and Waters appearing in Vol. 27 of the Bulletin of the Johns Hopkins Hospital for November, 1916; it is one of

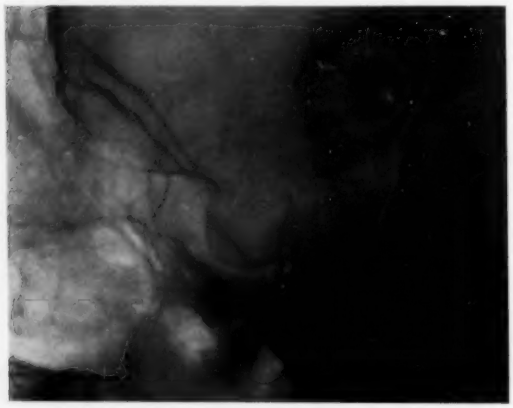


FIG. 10.

the best studies which has appeared in English.

Schueller (7) in his excellent monograph describes the changes in the region of the sella as follows:

"Intrasellar tumors of the hypophysis cause a widening and deepening of the sella of such a nature that its floor is thinned and approaches near to the floor of the middle cranial fossa; further, the dorsum sellæ is thinned, displaced backward and inclined to appear lengthened. The transition of the contours of the dorsum sellæ into the planum sphenoidale forms an acutely-angled prominence. The anterior clinoidal process appears normal or pushed upward, and its under surface either hollowed out or abnormally plump. The remaining part of the skull frequently shows the changes of acromegalia (thickening of the wall of the skull, bony ridges, and enlargement of the pneumatic spaces).

"Extrasellar tumors of the hypophysis cause a flat dish-like widening of the sella, whereby the dorsum sellæ is thinned and shortened, the anterior clinoid process sharpened and shortened, the tubercle of the sella eroded, so that the floor of the sella is not alone thinned but, approaching slightly to the floor of the middle cranial fossa, appears to fuse in an obtuse angle with the planum sphenoidale. The remaining part of the skull indicates no acromegalic changes, but rather a thinning of the walls due to an increase of the intracranial pressure."

"Very large tumors of the hypophysis cause a total destruction of the body of the sphenoid. In this stage it is impossible to differentiate those of intra- and extrasellar origin; at best, the condition of the anterior clinoid process, together with the other changes in the skull, points the way. The guides cited above must do service in the majority of all tumors of the hypophysis, and before their value in diagnosis can be discussed, the following considerations must be taken into account. The destruction of the sella, due to tumors of the hypophysis, has a great similarity to that occasioned by other disease processes of the base of the brain, as well as to those showing signs which are due to general increase of the cerebral pressure, the

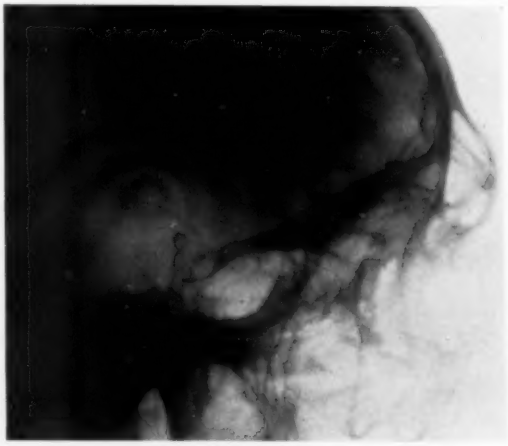


FIG. 11.

latter causing erosions of the inner surface of the skull."

VI.—It will be seen, therefore, that these changes are due to pressure in a great majority of instances, manifested

FIG. 12.

either locally or generally. Tumors of the anterior fossa may show a pressure atrophy of the anterior clinoidal process and over the sella itself, while tumors of the posterior fossa show a rather general pressure due to development of hydrocephalus and but rarely evidence of direct pressure over the body of the tumor itself. Moreover, the pressure from posterior fossa tumors is that of the rapidly developing hydrocephalus, whereas anterior fossa tumors may and often do occur with very slow pressure signs.

Increase in intracranial pressure may be accompanied by enlargement of the skull and separation of the sutures with thinning of the skull and a localized striking pressure atrophy, a moulding of the skull by the convolutions of the cortex, a *general convolutional atrophy* of Spiller, the "impressiones digitatæ" of Schueller. In addition to these changes there usually occurs enlargement of the internal auditory meatus, which may be recognized as of diagnostic value.

Heuer and Dandy have studied the vascular changes in the skull in a hundred cases of brain tumor. In fifty cases they noticed an enlargement of the cerebral vessels in the region of the middle menin-

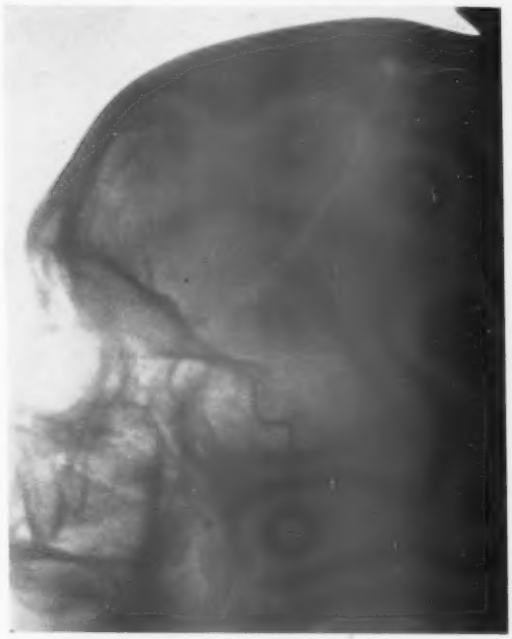


FIG. 14.

FIG. 13.

geal artery or of the diploetic or extracranial sinuses of the skull. In four of these patients there was a marked unilateral dilatation of the cranial vessels. The closely connected network of the vessels drained into a single vascular trunk. Each of these patients had a dural endothelioma, lying within the area indicated by the vascular network, which is beautifully shown in the roentgenogram.

They have also observed the stellate diploetic sinuses in the parietal region as spoken of by Schueller and also observed and noted by myself, stating that these occur

FIG. 15.

regardless of the location of the lesion. While this is merely a sign of venous stasis, it seems to be entitled to a certain value as being evidence of the existence of marked interference with the blood supply in the return circulation and hence strongly suggestive of the existence of tumor.

VIII.—As a preliminary to any studies of the pituitary region the very best possible roentgenograms should be obtained. The technic, as described by me on a previous occasion, is as follows:

Employ finely focused, heavy anode transformer tubes of the hydrogen type, working at a voltage not exceeding 60,000 and usually less, with an exposure of 200 MA-seconds and fairly fast plates with fine grain. Intensifying screens are not employed, since the necessary detail can not be obtained thereby. Other requisites are absolute immobilization of the head and the employment of small diaphragms. The patient lies upon the side with the head upon an adjustable block just high enough to permit of leveling the head with the table.

The center of the sella turcica is determined by indicating a line from the glabella to the external auditory meatus. At a point one and one-quarter inch anterior to the meatus on this line, a perpendicular line, three-quarters of an inch high, is erected, and through the point established at the end of the perpendicular the principal ray is passed so that it may emerge at a corresponding point on the opposite side of the skull. This method of location has been found to be sufficiently accurate in the majority of my cases to produce a test plate. By this I mean a plate in which the floor of the sella appears as a sharply defined white line and the anterior and posterior clinoidal processes are respectively superimposed upon their opposites. This plate having been obtained, a stereoscopic pair may be made in addition, it being recommended that the stereoscopic movement be from above downward toward the base rather than from the glabella toward the occiput.

In addition to the lateral plates of the skull it is advisable to make at least one

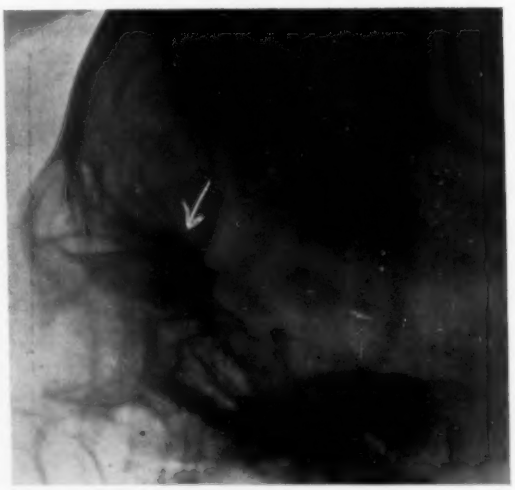


FIG. 16. OSTEOMA OF FLOOR OF ANTERIOR FOSSA.

plate involving the long tubular diaphragm, having a diameter not greater than 2½ inches and a length of at least 8 inches, since unexpected detail is frequently developed on such a plate.

Conclusions.—The first requisite for study of intracranial lesions, particularly of the sella, is a wide familiarity with roentgenograms of the normal conditions and mastery of a technic resulting in uniform production of roentgenograms of unusual definition and excellence.

There is a wide variation in size and character of the sella which must be considered within the limits of the normal.

Idiopathic epileptics in a large proportion of cases show definite changes in the region of the pituitary.

Pituitary struma manifests itself by deformation and destruction of the sella, rarely by visualization of the tumor itself. Intracranial tumors other than those of the pituitary frequently so manifest their presence as to permit of their detection by roentgenography.

Every patient showing evidence of optic atrophy, bitemporal hemianopsia, papilloedema or loss of vision, is entitled to a careful roentgen exploration of the sella and intracranial region.

REFERENCES

1. Oppenheim, H. *Arch. f. Psychiatrie*, 1901, XXXIV, 303.
2. Erdheim, J. "Ueber einen Hypophysentumor von ungewöhnlichem Sitz." *Beitr. z. path. Anat. u. z. allg. Path.*, 1909, XLVI, 233–240.
3. Kohler. "Technique de l'exploration radiographique de la selle turcique pour le diagnostic des tumeurs de l'hypophyse." *Jour. de radiol.*, 1909, III, 5.
4. Jaugeas, F. "The X-ray Diagnosis of Tumors of the Hypophysis." *Arch. Roentg. Ray*, 1910, XV, 87–89.
5. Fuchs, A. "Die Diagnose des Hypophysentumors." *Jahrb. f. Psychiat.*, 1905, XXVI, 230–252.
6. Heuer, George J. and Dandy, Walter E. "Roentgenography in the Localization of Brain Tumor." *Bull. Johns Hopkins Hospital*, vol. XXVII, No. 309, 1916.
7. Schueller. "Roentgendiagnostik der Gehirnkrankheiten." *Allg. Chir. d. Gehirnkrankheiten*, 1914, No. 339.

X-RAY PROTECTION

When the discussion on *x*-ray protection was resumed at the Roentgen Society's meeting on March 7th, 1916, Dr. W. Hartwood Nutt said that he was inclined to believe that the tired feeling of which *x*-ray workers complained was due not to ionization but to ozone, which, according to some qualitative tests, was liberated by *x*-rays. Dr. G. B. Balten laid stress upon the danger of associating work with chemical substances, especially alkaline materials, with *x*-ray manipulation. He had noticed a dermatitis supervene in a case of ringworm which previously had been treated with picric acid. Major Wilson, Canadian Medical Corps, said that the ideas of British manufactures with regard to protection were certainly below the standard deemed necessary with the heavy transformer outfits obtained from the United States and Canada. In the Canadian military hospitals the most complete rubber protection was insisted upon, and a layer of 8 lb. lead (if possible a double layer) was passed around the tube box. The President (Mr. J. H. Gardiner) announced that the authorities of the National Physical Laboratory had stated that they were prepared to examine any protective material submitted to them, and to give a certificate upon its absorption coefficient.—*British Medical Journal.*

ON THE PHYSICO-CHEMICAL NATURE OF THE ACTION OF RADIOACTIVITY ON PROTOPLASM

BY A. RICHARDS, PH.D.

WABASH COLLEGE, CRAWFORDSVILLE, IND.

and

ALVALYN E. WOODWARD, M.S.

SIMMONS COLLEGE, BOSTON, MASS.

A MASS of information is now available on the changes which may be expected in living matter when it is exposed to the action of roentgen or of radium rays. Yet it is obvious from even a cursory examination of the question that no explanation in any true sense of that term has thus far been offered to account for these biological effects. What is the mechanism by which the rays are able, for example, to change the rate of cell division and at the same time prevent the chromosomes from taking their normal place on the spindle in mitosis, or by what means can the activity of an enzyme be influenced by mere exposure to the rays? It is in an effort to make more concrete our thinking about these matters, to offer a mental picture, even though imperfect, of the processes that may be conceived to be taking place inside a cell when it is radiated, that the following suggestions are formulated. The end desired is to direct attention to certain of the physico-chemical principles which are involved in the phenomena and which must be taken into account in the final solution of the problem. It is scarcely the intention to present these suggestions as an hypothesis, unless it be of the most provisional character. They do not constitute an explanation, for, as is clearly recognized, there are many gaps and it is necessary to make several assumptions which are incompletely backed up as yet with experimental data. Rather they are put forward tentatively and in the hope that they present a more definite picture of the processes, and that they may point out possible lines of future investigation.

The property, possessed by roentgen rays in common with other forms of radioactivity, of modifying profoundly the structure and functions of living matter, is well known. All forms of radioactivity are able to bring about marked chemical action, and there appears to be little doubt that this is in some way connected with the ionizing power which all possess in greater or less degree. It has been found (Rutherford, "Radioactive Substances and their Radiations," 117) that the relative ionizing powers of the alpha, beta and gamma rays are approximately as 10,000, 100 and 1, respectively, and that the penetrating powers of these rays are represented approximately by these numbers in the reverse order.

Biological studies have also shown that the effects on living matter resulting from exposure to these rays are the most severe from the alpha rays and somewhat less from the beta rays, while the gamma rays are relatively only slightly injurious in some cases.

It is further found that, when an obstacle is interposed in the path of a primary beam of gamma rays, secondary rays would be produced and the rays thus generated are beta rays. Similarly in the case of roentgen rays, secondary and cathode rays are formed. According to Bragg (*Phil. Mag.*, 14, p. 429, 1907; 15, p. 663, 1908; 20, p. 385, 1910) the roentgen and gamma rays and the beta rays are mutually convertible forms of energy. Now so small is the

amount of ionization produced by the gamma ray that there is a question as to whether the beta rays are not responsible for all of it. Bragg concludes that the evidence favors the view that no ionization is produced by the gamma ray until its energy is transformed into a beta ray by its incidence upon some atom. In which case the more penetrating roentgen or gamma ray would produce indirectly a relatively large amount of ionization due to the generation of the secondary beta radiations, or secondary cathode particles, as the case may be.

Under the ordinary conditions of the application of radioactivity, the alpha rays are all screened out and need not be taken into consideration. Their penetration is so slight that the capsule in which they are contained is sufficient to screen them out. To the beta rays, then, are due practically all the effects; and the roentgen rays, because of the intensity with which they may be produced and the large amount, are perhaps the most effective of all these agencies in setting up changes in tissues. Obviously, the fact that secondary radiations are produced must needs be taken into account when the nature of these changes is considered.

Secondary radiations vary greatly in amount and in character, depending upon the nature of the atom with which the primary beam comes in contact. Incidence upon atomic particles of any element may cause them, however. Colloidal substances and tissues, under the influence of the primary roentgen or of gamma rays, will generate secondary radiations. Coutard (Colwell and Russ, "Radium, *X*-Rays, and the Living Cell," p. 55) found that when water, serum, blood, and tissues were interposed in the path of gamma rays, secondary rays were induced in the following percentages of the intensity of the primary beam: respectively, 3 per cent, 3.5 per cent, 5 per cent, 7 per cent. It follows that the same general phenomena, although doubtless more complicated, will occur when living matter is radiated that take place in certain colloidal solutions when subjected to the action of radioactivity, especially if they contain some of the commoner salts present in protoplasm. Particularly would this be true in the case of eggs which develop only when immersed in water. It follows further that the explanation of these phenomena will take account of the ionization due to beta and gamma rays.

The property of decomposing water possessed by the radiations of radioactive matter has been investigated by a large number of workers, and from these researches there appears to be no doubt that the decomposition is brought about by all three kinds of radiation. In the experiments of Ramsey and Soddy (*Proc. Roy. Soc. A.*, 72, p. 204, 1903) it was found that 50 milligrams of radium bromide in solution evolved gases at the rate of about .05 c.c. per day. In this gas there was always an excess of hydrogen over that which would be expected from the normal decomposition into two volumes of hydrogen to one of oxygen.

In bringing about this decomposition the effect of the alpha rays is much greater than that due to the beta and gamma rays. In addition, the reaction is to a certain extent reversible, for some of the hydrogen and oxygen recombine under the influence of the radiation to form water. (Cameron and Ramsey).

Rutherford writes: "Estimations of the rate of evolution of the mixed gases have been made by Ramsey and Cameron, Debierne, Kernbaum and Usher.

"Debierne (*C.R.*, 148, p. 703, 1909; *Le Radium*, 6, p. 65, 1909) observed the decomposition of water in solutions of actinium and radium, and found that one gram of radium in solution produced about 13 c.c. of mixed gases per day. The production of gases by beta rays has been examined by Debierne and Kernbaum (*C.R.*, p. 705; *Le Radium*, pp. 225, 352). The radium preparation was placed inside a double-walled glass vessel containing water. Debierne found by pressure measurement that

the evolution of gases proceeded at nearly a constant rate for over a month and then apparently somewhat more slowly. The rate of evolution in the glass was increased about five per cent. by placing a lead screen around the vessel. This increase was due to the effect of the beta rays excited by the gamma rays in the lead envelope. Kernbaum made a detailed study of the effect of the beta rays on water and showed that only hydrogen was evolved, while the oxygen remained with the water. He concluded that the beta rays, like the ultra-violet light, decompose the water in an abnormal way, which is represented by the equation $2\ H_2O = H_2O_2 + H_2$.

"It appears probable that the excess of hydrogen evolved from a radium solution, drawn as observed by Ramsey, is due to a similar action."

Rutherford says further: "There appears to be no doubt that the dissociation of matter by the radiations is connected with the ionization that must be produced in all matter by the action of the radiation. In the case of the water it appears probable that the ionization of the molecule of water is accompanied by the chemical dissociation of the molecule or of its components."

Kernbaum also exposed flasks of water to roentgen rays in order to test the decomposition effects from this form of radioactivity. (*C.R. Congrès international de radiologie et d'electricité*, I, p. 135, Bruxelles, 1910.) Although these exposures amounted to 100 hours, no evolution of gas or other alteration was noted. We have found no record of other experiments on water. It is to be remarked also that since the gamma rays of radium produce little or no decomposition of water, it is to be expected that exposure to roentgen rays would be equally ineffective, if the conditions of the experiment were not such as to insure their transformation into beta rays. These conditions would be met if the vessel were surrounded by some screen, such as lead, or if electrolytes or colloid particles were contained in solution.

From the results of all the experimentation on the biological effects of the various forms of radioactivity the safest and the most widely applicable generalization is that the rays act as a stimulus to metabolism. A weak stimulus is accelerative to all metabolic activities, both constructive and destructive; a strong stimulus becomes an over-stimulus and retards or, if strong enough, stops all activities of life. Moreover, in certain cases it is possible to find a stimulus between the optimum and the maximum points where no effect can be recognized, since here both the positive and the negative stimulation are equal. It is true, of course, that the other vital functions of organisms, as well as the metabolic, are sensitive to the effects of radioactivity, and some of these effects are due to the radiation acting directly. But at least to a certain extent, these effects are also due to the indirect action on the metabolism of the animal (for all vital functions are dependent for their successful conduct on the proper relation being maintained between the constructive and the destructive processes going on in the protoplasm.)

In attempting an explanation of these effects, there have been various hypotheses put forth, beginning about 1904. These hypotheses have been considered by one of the authors in another place (*Science*, 42, p. 287, 1915) and the view is there expressed that the most satisfactory attempt to account for the facts as now known is based upon a theory of enzyme modifiability caused by the radiation. It may not be said, however, that the modification of protoplasmic enzymes by the rays is the only factor involved, but the evidence is good that it is a very important one. A less recent attempt at explanation involves the direct decomposition of such substances as lecithin in the cell; from which decomposition, substances toxic to the protoplasm are produced. Explanations of this type are founded on insufficient evidence and are not now seriously considered. The experiments of the Hertwigs led to the hypothesis that the direct injury by the rays of the chromatin in the cells is the

source of the abnormal effects produced in the organism. Without doubt, chromatin suffers injury from roentgen or radium rays, but it can be shown as positively that other substances in the cell are likewise susceptible to radiation. Hertwig's suggestion that the injured chromatin may be regarded as a "contagium vivo" has more nearly the character of a vitalistic formula than of a scientific explanation. However near the truth it may be, it still must have a further explanation of chemical nature back of it, if any adequate picture of the mechanism by which the effects are brought about is to be gained.

There are now a sufficient number of experiments with positive results, so that it may be regarded as proved that the rays from radioactive substances are able to affect enzymes of various character. The experiments are by no means in accord, however, with reference to the details which would enable one to form any notion as to the manner in which the activity of the enzyme is accelerated or retarded, depending on the intensity of the radiation. Moreover, not all enzymes exist in the living cells as enzymes fully formed, but are there as zymogens. Before accurate knowledge of this phase of the subject is available, it will be necessary to study the relationships of zymogens of the living cell to the enzymes, the conditions under which the conversion of zymogen to enzyme takes place, and the behavior of these two bodies at the time of conversion when under the influence of radiations.

While it is the view of the writers that a theory of enzyme modifiability agrees best with the known facts, although it does not account, perhaps, for all of the effects produced by rays on protoplasm, yet it is clear that such an explanation as this is at best only a partial one, for any ultimate explanation must show what the method is by which the rays are able to induce changes in the action of the enzymes, and this must be largely a chemical matter.

Exposure to the rays from radioactive substances results in many cases in marked chemical changes, as is attested by the records of numerous investigations. Rutherford and others have called attention to the relationship which, without doubt, exists between this marked chemical action and the ionization that is produced by the rays in all kinds of matter. This has already been noted in the case of water.

So far as the writers' information goes, there has been but a single effort to work out, on the basis of their ionizing properties, a method by which the rays may be conceived to produce their effects on tissues. This is the suggestion by Joly (*Proc. Roy. Soc.*, Series B, v. 88, 1914) who compares the events taking place in a photographic film with those which occur in tissues exposed to gamma or to roentgen rays. He assumes that ionization is going on at all times in the living tissue and that the rays act by increasing this ionization. The differing results are explained on the ground of differing degrees of ionization and the presence or absence of a sensitizer or a restrainer. The former would accelerate the ionizing tendency by removing the products of the reactions as fast as they are formed, while the latter would place a limit on the ionizing processes either by its physical inertness or by its chemical properties. Joly has not offered experimental confirmation of his theory except on the basis of the similarity which exists between the reactions during the photographic process and those occurring as the result of radiation.

In the considerations which follow, the writers wish to deal chiefly with the effects of radiation on developing eggs, for the reason that in the present state of our knowledge we know more about the chemical conditions under which eggs will develop normally than about those which exist in adult tissues. Our knowledge of the biological changes is also more accurate in the case of the egg, and it is easier to recognize effects produced there as due to the radiations. We may think, then, of such a chemical system as that of a developing snail or sea-urchin egg, roughly an aqueous

system of colloids, which contain as well various salts in solution.

Taking up first the case of the exposure of the eggs to radium rays, we find that the reports of the experiments are in very general agreement on the point that a moderately strong radiation sets up destructive changes in the eggs. Where the experiments have included such conditions, it has been found also that a slight exposure is stimulative.

It may be assumed, as is doubtless the case, that during the life of the organism, be it egg or adult, the vital processes necessitate that a certain amount of ionization and consequent chemical dissociation should be going on continuously. In this case the action of the rays, both primary and secondary, would increase the ionizing tendency already manifest.

But it is stated that the rays ionize water according to the equation $2H_2O = H_2 + H_2O_2$, thus giving rise to nascent hydrogen. Now it has been shown that "pure albumen, perhaps like most pure emulsoids, is electrically neutral, and takes up + or — charges, especially in solutions containing H^+ or OH^- respectively." (Taylor, "The Chemistry of Colloids," p. 85.) This follows from the experiments of Pauli, as well as from those of Hardy (*Jour. Physiol.* 24, 288, 1899). It may be assumed that the proteins of the cell behave as does pure albumen, acquiring negative charges in an alkaline solution. Now sea water and blood, the solutions in which cells normally live, are both slightly alkaline,[1] and hence the colloidal particles of the protoplasm may be assumed to absorb OH^- ions and thus acquire negative charges. In other words, there would be more colloidal particles with negative than with positive charges. If this protoplasm be radiated, the consequent decomposition of water would set free positive hydrogen ions in small amounts, and the charges on the colloidal particles would tend to be equalized. It has been found that a colloidal suspension, in which the positive and negative charges are approximately equal, is less stable, and consequently more active than one in which there is an inequality of the charges. Burton found, for instance, in his experiments on the kataphoresis of silver solutions, that the maximum instability was reached at the point of electric neutrality, the isoelectric point. In the present case the system is rendered, by this equalizing of the charges, isoelectric, more unstable, and hence more active, and from this it may be inferred that increased metabolic activity would result.

If for any reason the charges on the colloids of the cell became positive, the findings of Mayer, Schaeffer and Terroine (*C. R.*, 1907, 145, 918) may be applied. They found that the addition of H^+ ions in quantity too small to cause coagulation led to a decrease in the size of the particles. In the present case the decomposition of water by radiation provides a source for the H^+ ions in small amounts. Now reactions take place more readily in a finely divided solution than in one in which the particles are coarser. Thus, here also, the chemical activity of the system would be increased.

It is probable, also, that a second process is going on which would tend to increase metabolic processes in either of the cases mentioned. The decomposition of the water by the rays produced not only H^+, but also a certain amount of H_2O_2. This unstable substance easily gives off free oxygen, and free oxygen combines readily, as in the usual case of protoplasmic oxidations, thus causing increased metabolism.

It is a matter of common observation that it is more difficult to produce changes by experimental means of any kind during the resting stage between two mitoses than during the mitotic period. This is to be explained by the fact that the cell constituents are in a more stable condition at that time, and that less ionization and

[1] L. Michaelis and W. Davidoff, *Biochem. Zeitschr.*, vol. 46, 1912, find that human blood is very slightly alkaline. Howell in his textbook gives data for both arterial and venous blood, showing that both are slightly alkaline. Loeb repeatedly states in "Artificial Parthenogenesis," and elsewhere, that sea water is alkaline, and Henderson, and Cohn, *Proc. Nat. Acad. Sci.*, vol. 2, p. 618, 1916, give a variety of data which show that sea water is always alkaline, the degree being dependent largely on the CO_2 concentration.

consequent metabolism is naturally going on. For the mitotic process makes great demands on the energy available in the cell and therefore an increase in the metabolism is required during the division. Thus the cumulative effect of the processes which are set in motion by the ionization due to the rays is lacking and slight results only follow from radiation at this time.

A prolonged or an intense radiation will inhibit the activities of an organism, or, if long enough, will cause complete cessation. This may be explained as due to subsidiary negative reactions which are taking place in the system. It is well known that electrolytes in solution will cause the precipitation of colloids, at least under the proper conditions, the precipitation being due to the ion of the opposite sign from the colloid. In the chemical system in which any developing egg, particularly a marine one, finds itself, there are considerable amounts of salts in solution. If now, due to the ionization effects, the colloid particles become charged, a prolonged radiation offers opportunity for their precipitation by the electrolytes. It is perhaps on some such basis that the injury to the chromatin and other cell constituents is to be accounted for. Unless removed, precipitations of this kind would at least serve to clog metabolic processes and thus inhibit mitoses; or the precipitates might even become actually toxic to the cell.

A second possible explanation for the inhibitory effect of prolonged radiation may be offered. If an excess of H^+ ions be added to colloids, they will depart further and further from the isoelectric condition, and so become more and more stable: if the process is carried far enough, they will be precipitated.

In the case of exposure of eggs to roentgen rays, largely similar effects have been reported. Here the same picture of the manner in which the acceleration or inhibition is brought about may be used, if the relationship of the secondary rays be taken into consideration. The entire process depends upon the ionization due to the activity of the rays. It will be remembered that gamma and roentgen rays are of themselves unable to produce effective ionization, but that when they encounter atomic particles of matter such as salts or electrolytes, they set up secondary rays which are able to cause ionization and which are able, therefore, to initiate the series of processes described here. The action of the secondary rays is sufficient to account for the processes involved.

We may think that a similar mechanism operates in producing the effects on enzymes, although less complete data are at hand to apply to this case. Enzymes are colloid, albumen-like bodies and, it may be supposed, behave with respect to their electric charges in a manner similar to albumen. Here too, it is found from experimentation that a slight radiation results—at least for the enzymes tested—in some acceleration of activity, while an intense one is destructive in its effect. These effects are obtained from enzymes in aqueous solution, and of course cell enzymes also act in the presence of water.

Some enzymes are found to act best in an alkaline medium, that is, when the particles are negatively charged (and those in marine eggs and living tissues would doubtless be in this group). As before, the ionizing effect of the rays is the starting point. Thus there is formed an excess of hydrogen ions. Here again the positively charged hydrogen ions would tend to equalize the negative colloidal particles, probably by being adsorbed. The suspension thus becomes more nearly isoelectric, and hence more unstable and active. In this way we may think of the enzyme as being activated.

In those cases where the enzymes work best in an acid medium (which would scarcely occur in living tissues or marine eggs) it would be expected that the preliminary accelerative period would be greatly reduced, for the radiation would produce H^+ ions in excess and thus cause an inhibitive precipitation. Data to enable one to say whether this expectation is borne out are not at hand.

As stated above, it is necessary to consider the effects of radiation, not only on the enzyme, but also on its zymogen. It has been established that in a number of cases the enzyme results from the hydrolysis of the zymogen. The fact that radiation causes the ionization of water, with the formation of H^+ and OH^-, suggests that in some cases the increased effectiveness of enzymes after radiation is due to a more complete transformation of the inactive zymogen into the active enzyme.

In case of the prolonged or more intense radiation, the dissociation of electrolytes may be supposed to occur in amount sufficient to precipitate the colloidal enzyme particles and thus remove them from the solution. Hence the solution would be less active. At a point where this process balances the one given above, the radiation would be non-effective; when this reduction is greater, that is, when the radiation is more intense, inhibition of the activity would take place; when it is insufficient to counterbalance the other, acceleration is the result.

REPORT OF A CASE OF ABSENT FEMUR

BY H. W. DACHTLER

TOLEDO, OHIO

BABY L. B., aged six months, the first child of healthy parents was referred by Dr. W. H. Rheinfrank for examination of the pelvis and thigh. The child was well nourished and healthy. The right thigh was short and thick but on physical examination seemed to have a normal knee joint. There was excessive mobility of the right hip but no pain on manipulation.

FIG. 1. CASE OF ABSENT FEMUR IN INFANT SIX MONTHS OLD

The roentgen examination shows the femur to be absent with the exception of a round mass about the size of the lower epiphysis of the femur at corresponding age, just above the knee joint and apparently forming part of this joint (Fig. 1). There is no deformity of the pelvis and the acetabulum appears normal. The plate shows slight increased density in the region where the shaft of the femur should appear, but this appears to be due to contracted deep muscles of the thigh rather than to cartilage. No sign of absorption is present. There is no evidence of an epiphysis for the head of the femur.

The parents are normal and there is no history of deformities in the immediate families of either.

CONGENITAL RADIO-ULNAR SYNOSTOSIS

BY GEORGE F. THOMAS, PH.B., M.D.

CLEVELAND, OHIO

CONGENITAL synostosis of the radius and ulna is quite a rare deformity. P. D. Wilkie, in an excellent article on the subject which appeared in the *British Journal of Surgery*, 1913–14, I, p. 366, and from which I have drawn very freely in the following paragraphs, mentions that previous to his report of the three cases he found only forty others recorded in the medical literature. Two of the three cases of this anomaly which I now wish to present with a brief description of the condition, were discovered in quick succession, as seems usual with such rarities, and the third occurred almost simultaneously in the practice of Dr. E. F. Freedman, who has kindly given me permission to report his case with mine.

Clinically this condition is indicated by a history of entire absence of pronation and supination of the forearm dating from birth, the forearm being fixed in a position of pronation, which gives it a somewhat deformed, twisted appearance due, in part, to the rotation of the forearm and also to the absence or lack of development of the pronator and supinator muscles. Flexion and extension of the elbow is quite free although there may be a slight limitation of extension. The limitation of rotation due to the synostosis is compensated in part by increased mobility of the wrist and shoulder joints.

According to Wilkie, two types of the lesion are recognized but, judging from the cases presented herewith, no sharp line of differentiation between them can be drawn. The cases seem rather to be a variation of degree than one of type. In one class, the radio-ulnar fusion is associated with congenital dislocation of the head of the radius. In this type the head of the radius is more or less normally developed and the point of fusion is below the head. The other type, considered the primary or true radio-ulnar synostosis, is that in which the upper end of the radius is not fully developed, but is fused to the ulna. The fusion in this type includes the head and extends several centimeters down the shaft.

Because of the fusion, there is a deficiency in the muscular structure which renders operative procedure of little value. In the first type, the upper portion of the

FIG. 1. CASE I.

shaft of the radius is fused to the ulna close to the coronoid process, with the bones in a position of pronation. This type is said to be more frequently unilateral, whereas primary radio-ulnar synostosis is a symmetrical deformity in 80% of the cases. There is a strong hereditary element in this condition which is more frequently found in the first type than in primary synostosis.

CASE I. (Dr. Freedman's Case). *Left Arm.*—Roentgenographically, this case is almost identical with the conditions found in the right arm of Case III. The right arm was found to be normal.

The important point to be remembered in reference to this anomaly is that operative division of the radius and ulna at the point of fusion affords very little hope for improvement in most cases, because of the deficiency in the muscular structure. Even in as simple a case as the left arm of Case III, there was no improvement after operation.

FIG. 2. CASE II.

CASE II. In this case, as can be seen from the plates, the lesion in both elbows is practically identical. The plates show complete fusion of the upper end of the radius with the ulna with no layer of compact bone along the line of fusion. In the anteroposterior views one can make out a partially developed radial head to the outer side of the coronoid process to which it is fused. One cannot make out definitely in the lateral views any shadow of the radial head. In the left arm there is a marked anteroposterior curvature of the radius, which, however, appears quite straight in the lateral view. The shaft of the radius is stouter at the upper end than the ulna. There does not appear to be any enlargement of the external condyle. The lower ends of the radius and ulna appear quite normal. In the right arm the mass of bone at the point of fusion is greater than in the left arm, and the shaft of the radius is also larger.

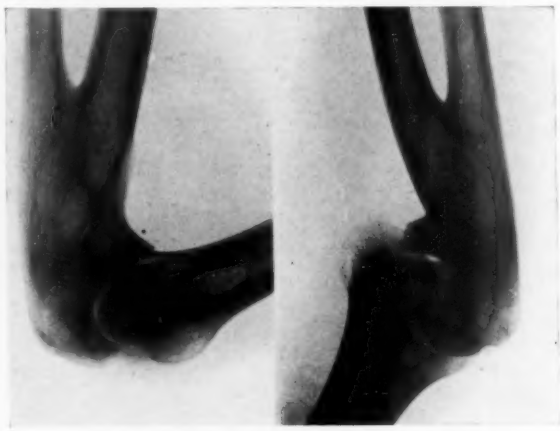


FIG. 3. CASE II.

CASE III. *Right arm.*—This seems to be a good example of the primary type. There is no evidence of the formation of a radial head, but the radius can be traced to a position posterior to the external condyle. There is a marked anteroposterior and lateral curvature of the radius, and the

upper portion of the shaft of the radius is larger than usual.

Left arm.—This illustrates the first type where the point of fusion is below the head which does not occupy an entirely normal position. The radial head in this case is large and deformed with the epiphysis small and directed out of the normal line of development. The line of fusion is rather short and is along the inner side of the upper end of the shaft. The radius appears quite straight and the size of the shaft is quite normal in comparison with the ulna.

FIG. 4. CASE III.

FIG. 5. CASE III.

This case is of special interest because it presents examples of both types of the lesion. The right arm and the right elbow illustrate the primary type, whereas the left arm is as definitely a case of the first type in which the head of the radius is fairly well developed separately from the ulna, with the point of fusion at the upper end of the shaft.

FURTHER OBSERVATIONS ON THE ROENTGENIZATION OF THE THYMUS GLAND IN GRAVES' DISEASE*

BY CHARLES A. WATERS, M.D.

Instructor in Roentgenology, Johns Hopkins Hospital and Medical School

BALTIMORE, MD.

THE substance for this short report follows the observations made from 99 cases of exophthalmic goitre treated by roentgenizing the thymus gland alone, although a few of these cases have subsequently received irradiation to both the thyroid and thymus glands.

The types of cases irradiated include the following: hyperthyroidism 33; exophthalmic goitre 47; colloid goitre 2; adenomata 5; dysthyreosis 2; persistent hyperplastic thymus 4; cyst thyroid 4; status lymphaticus 1; myasthenia gravis 1.

Of this group seventeen cases were irradiated before operation, thirty-four following operation and six were irradiated before and after operation, while thirty-eight received irradiation without any surgical interference. Fifty-two cases had partial or complete lobectomy, while eleven had only one or more thyroid arteries ligated. The treatments were given in series which consisted of a full erythema dose given through six portals of entry over the upper anterior mediastinum in the region of the thymus gland.

A few of the earliest cases received one exposure a day, while the majority received complete irradiation at one seance which consisted of a six-minute exposure with a 7-inch spark gap, 5 milliamperes passing through the tube, filtered through 1 mm. of aluminum at a focal distance of 20 cm. At present we are using a somewhat different technic substituting a 9-inch spark gap and a Coolidge tube.

40	cases	received	1	series	
23	"	"	2	"	
26	"	"	3	"	
5	"	"	4	"	
2	"	"	6	"	

Those of you who are familiar with the earlier papers on this subject, Stoerk,[1] Sinozersky,[2] Halsted[3] and myself,[4] will remember that we felt very much elated over the possibilities of this form of treatment and, although Stoerk and Sinozersky have not expressed their present views, Drs. Halsted, Barker, and others at the Johns Hopkins Hospital are much more skeptical as to the efficacy of this treatment than they were two years ago.

In 1915 when we reported successful results following *x*-ray treatment of the thymus in exophthalmic goitre, our reasons for so doing were chiefly based upon the patients' own story. These we soon found were erroneous and that careful physical examinations from time to time showed practically no change in any of their symptoms.

The patients would often reply that they were feeling fine and better than they had for years, while at the same time, their exophthalmus, tachycardia, tremors, pulse and eye signs would remain unchanged.

Also, the differential blood counts were carefully studied and it was not uncommon for the student or interne to make differential blood counts every hour for the first twelve hours and then 4 or 5 counts daily for two or three weeks.

These blood counts we thought were an index to the degree of lymphoid proliferation and inasmuch as the thymus is the largest local accumulation of lymphoid tis-

[1] Stoerk: Thymusbestrahlung bei M. Basedowii, Gesellsch. f. inn. Med. u. Kinderheilk. in Wien. 1913, xv, 231.

[2] Sinozersky, A. A.: Roentgen Exposures to the Thymus in Treatment of Exophthalmic Goitre, Russk.-Vrach., June 20, 1914.

[3] Halsted, W. S.: The Results of the X-ray Treatment of the Thymus Gland in Graves' Disease, Bull. Johns Hopkins Hosp., 1915, xxvi, 55; Harvey Lecture, The Significance of the Thymus Gland in Graves' Disease, March 14, 1914.

[4] Waters, C. A.: Roentgenization of the Thymus Gland in Graves' Disease, The Journal of the American Medical Association, April 24, 1915, Vol. LXIV, 1392–1394.

* Read before the Mid-Winter meeting Eastern Section of A.R.R.S. at Atlantic City, January 26–27, 1917.

sue, with the exception of the spleen, we thought it would be an index as to the size and activity of the gland.

After a few days or, in fact, several hours after irradiation, the differential blood counts would begin to show a slight polymorphonuclear increase with a mononuclear decrease.

This change would progress for several days up to several weeks when the count would return, approximately, to its original state and, after a period of two or three months no relationship could be attached to the blood picture and the state of hyperthyroidism. We now know that roentgen exposure to other parts of the body, other than the thymus gland and spleen, show the same characteristic polymorphonuclear increase and mononuclear decrease. We know, also, in accordance with the work of Murphy and Morton[5] of the Rockefeller Institute, that roentgen exposure to a living animal produces, in mild doses, a proliferation of lymphoid tissue, while in larger doses will cause a destruction of lymphoid tissue, so that the reason for saturating the thymus gland with roentgen irradiation is evident.

For instance, a typical example of our experience can be seen from the following case: We have under observation a patient who came to us in October, 1916, suffering with exophthalmic goitre which developed suddenly three years ago during an alcoholic debauch. Since then he has received every kind of medical and surgical treatment. A year ago a left lobectomy was done and gradually, but slowly, the patient began to show definite improvement, so that, when he consulted us, he had been slowly improving for eight months.

His physical examination of the cardinal symptoms before beginning irradiation showed positive tachycardia, positive tremor, pulse 99, marked exophthalmus, positive von Graefe, positive Stellwag's sign, lymphocytosis of 35%.

During the past four months he has received six series of irradiations consisting of 15 minute exposures over the right and left side of the upper portion of the sternum in the thymus region. These treatments of 15 minutes each, consisting of 5 milliamperes current, 9 inch parallel spark gap, filtered through 3 mm. of aluminum and glass, produced no erythema but epilation of the chest hairs, which we call a full erythema dose.

This patient to-day is decidedly improved although the exophthalmus, pulse, tachycardia, tremor, Von Graefe, Stellwag's, etc., have been practically uninfluenced during the period of irradiation. His pulse, at the time of writing was 89, while his lymphocytes had decreased 13%.

We are confronted with this question: has his slow improvement resulted from the roentgen treatment, or has it resulted from the natural tendency of this patient to improve who was showing decided improvement when roentgenization was begun, and who remained under careful dietary and routine restful living?

These are the two questions which, to my mind, must be carefully considered before arriving at any positive conclusions.

In examples of this kind, may it not be probable that one can cause subjective and symptomatic improvement in a patient without causing a disappearance of the typical objective signs of the disease?

To answer one more question, we must take into consideration the rôle played by the thymus gland, if there be such a rôle, in the pathology and symptomatology of exophthalmic goitre.

If there is a part played by the thymus in the symptomatology of this disease, is it not entirely possible that we can influence the subjective symptoms of a patient by thymus irradiation without presuming to cure the malady?

This would be indicated by the results shown in our series of 99 cases which we have closely observed and in which there has been undoubted subjective improvement but without a disappearance of the cardinal objective signs of the disease.

[5] Murphy, J. B. & Morton, J. J.: The Lymphocytes in Natural and Induced Resistance to Transplanted Cancer.—Studies in Lymphoid Activity. *The Journal of Experimental Medicine*, xxii, 1915.

MULTIPLE VIEWS ON ONE PLATE

BY CHARLES B. DANRUTHER, M.D.

LAPORTE, IND.

THERE are a number of cases in roentgenological practice where it is desirable to compare the views of corresponding parts of the same body with each other. Such comparison would be facilitated, if these different views were taken on only one plate instead of several. Incidentally, the expense of making say four roentgenograms on one plate would be less than using four separate plates. Besides, the convenience of the arrangement would induce the roentgenologist to resort to the device of multiple roentgenograms much oftener, thereby possibly discovering important conditions which might not be discovered without them.

The arrangement is as follows:

Using an 11 x 14 plate, marked as in Fig. 1, and a piece of lead plate of the same size but with one quarter cut away, as shown in Fig. 2, it will be seen that four exposures may be made on one plate by placing the lead plate over the sensitized plate, and for each subsequent exposure changing the position of the lead plate as desired. Thus, in the first exposure the areas 2, 3 and 4 are covered with the lead plate, leaving area 1 exposed; for the exposure of area 2 the sections 1, 3 and 4 are covered; covering of sections 1, 2 and 4 would expose area 3, and covering of 1, 2 and 3 would expose 4.

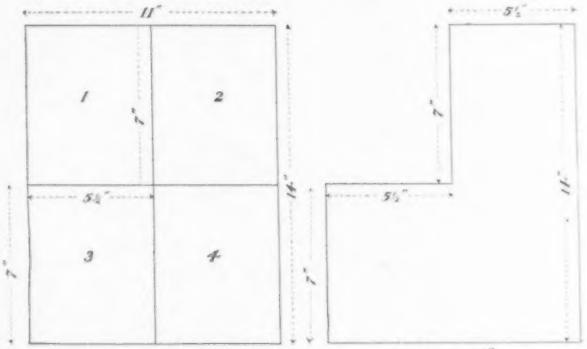


Fig. 1. Fig. 2.

This simple device is very useful in injuries of the extremities, when views of the other extremities are desirable, especially in children and young adults where ossification is incomplete and fracture or separation of the epiphyses is doubtful.

ROENTGENSTEREOSCOPY APPLIED TO THE EXAMINATION OF THE EXTREMITIES

BY PAUL M. STROTHER, M.D.

LYNCHBURG, VA.

SO far as the principle of applied stereoscopy in general or roentgenological practice in particular is concerned, I do not lay claim to any innovation in submitting the method I have worked out for making right-angle examinations of the extremities, but as I have not noticed in the literature or elsewhere any mention of this method of application for this particular purpose, I believe the idea may be turned to useful account in a great many more cases than it probably is at present. It has done and continues to do excellent service in my practice and I feel that

it has some points of merit to commend it.

The technic consists in covering one half of the plate field on the stereoscopic plate changer with lead and making stereoscopic exposures on the uncovered half; covering this half and repeating the process on the unexposed portion, but placing the part to be examined in a different position, preferably at a right angle to the previous one. In this way each plate presents the conventional anteroposterior and lateral views which are suited to direct study, while by the use of the pair simultaneous stereoscopy from two directions is available.

There is no need for the target to be centred differently for each pair, as a common point over the middle of the plate will give good results, but when particular importance is to be attached to obtaining the true right-angle relations, better results will be possible from using a separate point for each position.

In comminuted fractures, especially those involving the elbow and the knee, these plates will often give a more accurate and certainly a more graphic portrayal of the prevailing conditions than is accorded by a single right-angled plate or by stereoscopy from one direction.

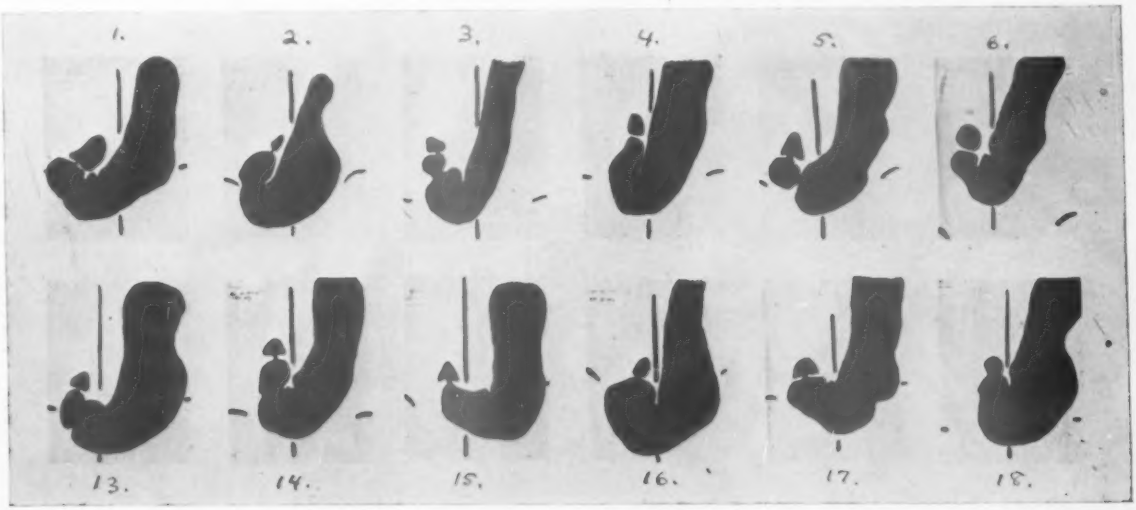
RIGHT-SIDED POSITION OF THE STOMACH IN INFLAMMATORY CONDITIONS IN THE ILEOCECAL REGION*

BY HOWARD E. RUGGLES, M.D.

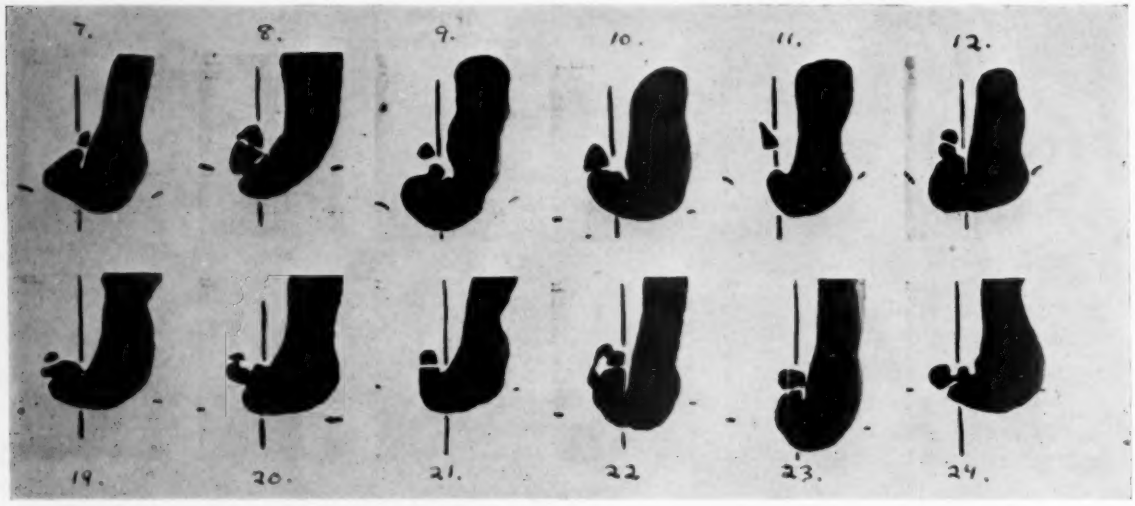
SAN FRANCISCO, CAL.

SOME time ago our attention was called to the right-sided position of the stomach in a case (No. 2) of extensive adhesions involving the ascending colon and omentum. Subsequently, in several cases which showed much the same displacement of the stomach, no sufficient evidence was discovered at operation to account for it. There were neither involvement of the omentum in the inflammatory process about the appendix nor gall-bladder adhesions. Roentgenoscopically these stomachs are freely movable but always return to the same position. The reason for this appearance is therefore not obvious, but the finding itself is quite definite.

As seen in the accompanying charts, half of a series of twelve cases show displace-



* Read before the Pacific Coast Roentgen Society, December 1916.



ment of the body of the stomach, evidenced by shifting of the incisura angularis to the right of the middle line.

These tracings were all made from plates taken in the standing position, and only those cases were included where the position of the stomach was constant in two or more plates besides the screen examination and in which the exposure was a true anteroposterior; that is, where symphysis and spinous processes lie along the same line. The vertical lines represent tips of spinous processes—the short curved ones at each side indicate iliac crests (Charts I and II).

The upper row of each pair (numbered 1–12) are from cases shown at operation to have adhesions or disease in the ileocecal region. The lower rows for comparison being individuals found at operation to be free of ileocecal adhesions (Nos. 13–18), and supposedly normal medical students with no clinical or roentgenological evidence of appendical disease (Nos. 19–24).

The first six cases show this displacement very well. The second six cannot be distinguished from normal so that the finding is of value in only half of the cases. It will be noted that this position of the stomach is quite distinct from that seen in gall-bladder disease with adhesions, where the stomach is usually much higher and further to the right. The point is that when a stomach of this type is observed, the ileocecal region should be subjected to an unusually thorough examination for other evidence of pathology.

Based upon this finding and unsupported by further roentgen evidence, we have recently reported a questionable diagnosis of chronic appendix in four cases which were later confirmed by operation.

We realize the limitations of the material presented, but believe it of sufficient importance to warrant further investigation.

REPORT OF A CASE OF TUBERCULOUS SPONDYLITIS

BY PAUL EISEN, M.D.

CHICAGO, ILL.

THE patient was a woman, 28 years of age, who had had pains in the left groin eight months prior to being seen by Dr. Bernard G. Katz. There was a tumefaction in the left hypochondrial region as large as a child's head. No fever. Patient had lost about 20 lbs. in weight. Bimanual examination revealed a freely movable uterus and a mass not connected with the adnexa. There were neither intestinal

nor motor disturbances, nor any complaints in regard to extension or flexion of the spine. Although there was no protrusion of a spinous process, some pain was elicited on extreme pressure in the region over the first to the third lumbar processes. The dorsal plates of the hip-joint, of the sacro-iliac synchondrosis and of the lumbar vertebræ, including stereograms, appeared negative, whereas a lateral plate showed a filling defect taking up more than half of the body of the second lumbar vertebra. A protrusion corresponding to a ridge at the lower border of the body of the first lumbar is also seen, and this makes the location of the disease a certainty. The tumor was punctured and about a quart of a yellow-green fluid, containing lymphocytes, was aspirated but neither this nor the cultures revealed tubercle bacilli. No animal was injected. Immobilization of body resulted in disappearance of tumor mass, and the patient gained thirty pounds in weight in the course of two months.

The case is communicated to show the value of lateral exposure in a suspected case of this kind, where dorsal plates have failed to reveal any anatomical irregularities.

CASE OF IMPAIRED EXTENSION OF THE KNEE-JOINT

BY MAXIMILIAN J. HUBENY, M.D.

CHICAGO, ILL.

THE patient in this case was a young man, 19 years old, who had complained during the last few years of impaired extension of the knee-joint, the attempt being attended with slight pain. The previous history furnished no indication of the cause and was negative for trauma. The affected region approximates the insertion of the posterior crucial ligament, and Alban Kohler mentions trauma, infarct and osteochondritis dissecans as possible causative factors.

Frequent roentgen examinations have been made during the past eighteen months and showed the process to be stationary. The arrows in the accompanying roentgenograms indicate the area of distinct demarcation on the inner condyle of the femur.

FIG. 1

FIG. 2

IMPAIRED EXTENSION OF KNEE-JOINT
Arrows point to demarcation of inner condyle of femur

AN UNUSUAL GALL-BLADDER COMPLICATION

BY JESSE SHOUP, M.D.

WASHINGTON, D. C.

THE following is the report of an unusual case of abdominal pain involving the gall-bladder, in which the clinical signs were insufficient to make a reliable diagnosis and where, with the aid of the roentgen interpretation, the nature of the condition was sufficiently revealed to warrant an operation which in its essential findings verified the suspicions of the consultant roentgenologist.

The clinical history was as follows: The patient was a married woman, nullipara, 45 years of age, and weighed 200 pounds. In 1910 she had an attack of typhoid fever, from which she fully recovered. Otherwise, according to the anamnesis, she experienced no signs of ill health until July, 1915, when she was seized with pain in the right hypogastrium. These attacks, somewhat varying in locality and severity, were of frequent occurrence and more recently have been the source of almost constant complaints. The pain was described as being of a dull, heavy nature, often assuming a pressure-like character. When lying on her left side, she complained of a pulling sensation which caused exacerbation of the pain. On the other hand, the intensity of the pain was somewhat relieved by wearing corsets or making pressure over the seat of pain.

At the time the patient presented herself for examination and treatment, the pain was rather constant over the region of the gall-bladder and was relieved by ingestion of food, either solid or liquid. While she was able to retain the food, there were occasional eructations and vomiting of a sour, bitter fluid which relieved the pain for the time being.

After the administration of an Ewald test breakfast the stomach contents were withdrawn and found to contain a high percentage of total acidity and of free hydrochloric acid.

At this stage it was thought desirable to invoke the aid of a roentgen examination of the gastro-intestinal organs. The stomach was found to fill normally, its position to be vertical with apparent fixation in the region of the pylorus and to extend slightly below the umbilicus. Hyperperistalsis was present to a marked degree. The duodenal bulbus could not be outlined satisfactorily in the roentgenograms. From observations and careful study of the roentgenograms it was estimated that at the end of four hours there was the equivalent of a two-hour residue, but at six hours there was only a shadow of what might have been a remnant of this residue. A number of roentgenograms were taken up to twelve hours after ingestion of the barium meal, and in all of them a persistent shadow was seen in the region of the duodenum. Only one of the roentgenograms is shown in the accompanying illustration, as, unfortunately, the other films did not reproduce.

All of the roentgenograms were sent to Dr. J. T. Case with a request for his interpretation in the endeavor to arrive at a correct diagnosis. Dr. Case returned the films accompanied by the following comment: "The possibilities which occur to me are as follows: a diverticulum of the duodenum, a perforating ulcer, or even barium in the gall-bladder."

Having in view the possibility of the presence of any of these contingencies, operation was decided upon and performed January 20, 1917. The operative findings revealed the following conditions: There were dense adhesions between the duodenum and the liver, hiding the gall-bladder from view. The adhesions were separated so as to expose the gall-bladder to view, and its fundus was then found to be connected with the duodenum by means of a tube half an inch in length and as thick as a normal appendix. The fundus of the gall-bladder was empty except for a small amount of fluid which looked like duodenal contents. No bile was present in the gall-bladder, but on further exploration it was found to harbor a soft cholesterine stone which completely filled the neck of the gall-bladder, blocking the entrance to the cystic duct. When the stone was removed, bile began to pour into the gall-bladder through the cystic duct which thereby proved to be patulous.

Thus the operative findings showed that the persistent shadow in the roentgenograms was caused by barium which had found its way to the fundus of the gall-bladder, as was correctly anticipated in Dr. Case's judgment; the suspected connection between the duodenum and the gall-bladder, to which the roentgen shadows gave rise, was also borne out by the presence of the isthmus revealed at operation.

This case is reported on account of its rarity and the pleasure it gives me to record Dr. Case's diagnosis.

DEXTROCARDIA WITH MITRAL STENOSIS

BY ALBERT FRANKLIN TYLER, B.SC., M.D.

Professor of Roentgenology, Creighton Medical College

OMAHA, NEBR.

THE combination of dextrocardia and mitral stenosis is so rare that it merits attention. In searching the literature I have been unable to find any reported cases of this combination. The patient was referred for roentgen examination by Dr. Le Roy Crummer and through his courtesy I am able to report the findings in full. The case has the additional interest of showing complete agreement between the clinical findings and the roentgenological examination.

Mrs. L. S. Age 40, Nullipara. Has had palpitation and dyspnea for two years. Of

late she has been nervous. The pulse rises on exertion, pounding and fluttering, and then becomes regular. The heart thumps hard against the bed. The apex of the heart is on the right side. Dyspnea occurs only on exertion. There has been one attack of asthma. No edema, no nocturia, no liver distress.

Physical Examination.—There is a pale tinge of cyanosis. The apex beat is in the sixth interspace in the midclavicular line on the right side. The upper border is at the third rib on the right side. Extreme dullness is present at the third rib three fingers to the right of the middle of the sternum. The end of the curve is in the third interspace, with a curved border thence to the apex beat. The left border is 1½ finger's breadth to the left of the sternum, beginning at the fourth rib. At the sixth rib, the extreme left border is 1½ finger's breadth to the left of the sternum.

Auscultation.—At the base both sounds are equal. At the end of the sternum there is no murmur. In the sixth interspace at the apex on the right side there is a pure early diastolic sound whistling in character with a short presystolic ending in a sharp first sound. There is a transmitted second sound carrying very quickly after a sharp first sound. No systolic murmur. A short presystolic thrill is felt over the apex. No signs of decompensation. The liver is on the left side, but not enlarged. The stomach is on the right side with the pyloric area to the left of the median line. Free hydrochloric acid, 55° or 0.2+ per cent.

Roentgen Findings.—Screen examination revealed the heart in the position described above with the apex on the right side in the sixth interspace at the midclavicular line. The right side of the heart showed the double curve characteristic of a mitral stenosis with auricular enlargement.

The liver was on the left side, the cardiac end of the stomach was on the right with the pylorus on the left. The cecum was on the left with the descending colon on the right.

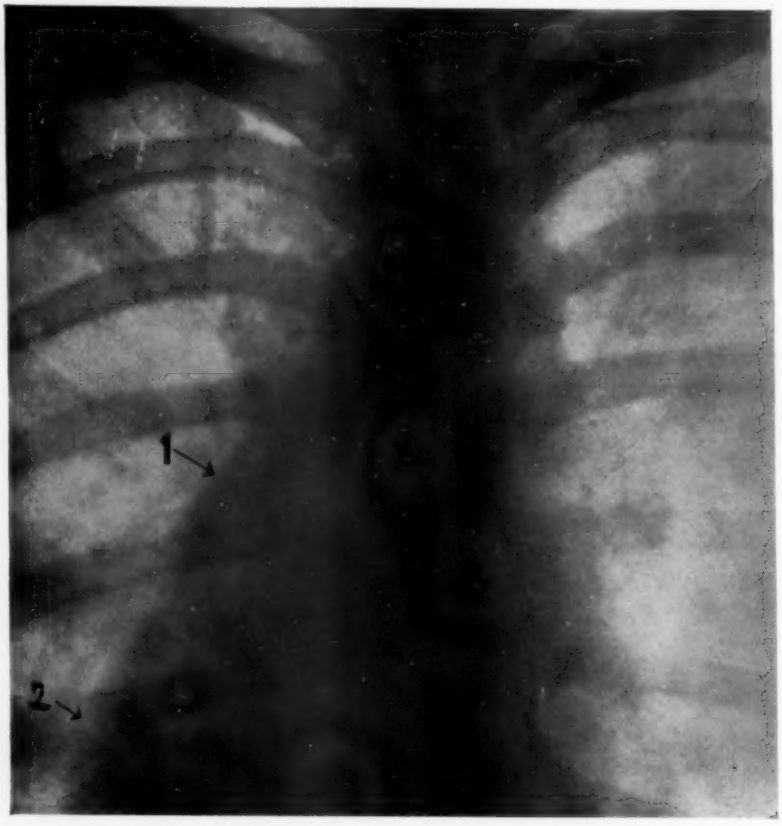


FIG. 1. 1. AURICLE. 2. VENTRICLE.
Note the enlargement of the auricle and the double curve of the heart.

THE AMERICAN JOURNAL OF ROENTGENOLOGY

PUBLISHED BY PAUL B. HOEBER, NEW YORK CITY

Issued Monthly. Subscription, $5.00 per year. Advertising rates submitted on application. Editorial office, 124 Manchester St., Battle Creek, Mich. Office of publication, 67-69 East 59th Street, New York

OFFICIAL ORGAN OF
THE AMERICAN ROENTGEN RAY SOCIETY

President

W. F. MANGES, M.D.,
264 S. 16th Street, Philadelphia, Pa.

First Vice-President

H. W. VAN ALLEN, M.D.,
19 Maple Street, Springfield, Mass.

Second Vice-President

H. M. IMBODEN, M.D.,
480 Park Avenue, New York, N. Y.

Secretary

WILLIAM H. STEWART, M.D.,
222 W. 79th St., New York, N. Y.

Treasurer

WM. A. EVANS, M.D., 32 Adams Av., W., Detroit, Mich.

Executive Committee

DAVID R. BOWEN, M.D.,	Philadelphia, Pa.
HOLLIS E. POTTER, M.D.,	Chicago, Ill.
L. JACHES, M.D.,	New York, N. Y.

Publication Committee

P. M. Hickey, M.D.,	Detroit, Mich.
GEORGE C. JOHNSTON, M.D.,	Pittsburgh, Pa.
DR. A. W. CRANE, M.D.,	Kalamazoo, Mich.

Librarian

H. W. DACHTLER, 224 Michigan St., Toledo, Ohio

Editor

JAMES T. CASE, M.D., F.A.C.S., Battle Creek, Mich.

EDITORIALS

FRESH FROM THE FRONT

The annual banquet of the Society missed a touch of fellowship and a twinge of German frightfulness when the following letter from Captain Percy Brown failed to reach us as its writer had intended. Unfortunately the transatlantic airplane mail service was not yet in operation. But the delay in no wise lessens the vivid sensation of a "close-up" cinematographic glimpse of hospital life somewhere in France.

The distinctive and irrepressible Brownian humor makes the signature to this letter superfluous. It is the fervid hope of his fellows that the lovable, undaunted and patriotic author of this communication will be with us in person to do his bit in his old way to make our next meeting a notable success.

"United States Army,
Base Hospital No. 5,
France, Sept. 6, 1917.

MY DEARLY BELOVED COLLEAGUES:

Following up a distinct threat which I had previously made to George Johnston (strictly by mail, for fear of retaliation), John Young and I have written, for presentation to you at this meeting, a communication which groans under the title 'Clinical Observations in Military Roentgenology, with Especial Reference to the Bismuth-iodin-paraffin Paste of Morison, and also to a means of Foreign Body Determination by Means of Secondary Emanations'—just like that. This title, and incidently the text, had been carefully prepared by us in spare moments between pushes, only for us finally to find that such a communication has to pass through the trench-mortar of Headquarters before it can burst, like a bomb from Fritz's 'taube' into print.

In other words, the great military gear-wheel of which I am but one of the many, many teeth, must not be disturbed in its groove. I am a molecule, an atom, or, if you please, an ion—rather, I should say, an electron when a 'convoy' is in, and we are busy. As a military electron, however, I seem of late to be cavorting about the target-end of the bombardment, for, on the night of the fourth, consistent with his usual tactics, Fritz came over and 'strafed' this hospital good and plenty. The Hun is especially strong in places where there is no possibility of retaliation,

but—it's arms up and 'Kamerad, Kamerad' when he sees the reflection of the moon along the bright blade of a sabre-bayonet. That, however, is 'another story,' albeit an old one. This night he came down from his base and dropped five on this camp of wounded men and Red Cross sisters. Those of us who were in bed 'got out and got under' I can tell you. After the fifth bomb had dropped, the tents of some of the officers looked like sieves. Mine presented a most interesting T and T wound and the point of entrance bore such a relationship to my bedside that, had I been carrying out my maternal instructions of former years and had been saying my prayers, I fear they would have been my last. As it was, I had just stepped out to another part of the camp to elevate a pair of night-glasses. Such is Nemesis. But what really happened? Three of our more recently-arrived officers from Kansas City (and I think Ned Skinner must know them all) were hit. One of them, Lieutenant F.— was literally blown to bits. Poor chap, he had just come in from a walk and had faced about at the entrance to his tent, just where the Boche that instant dropped two. Lieutenant W.— was writing in his tent, even as I am now. It got to him through the lung—he is fairly comfortable to-night. Lieutenant M.— but why continue? We had thirty-one casualties in all—five killed and twenty-six wounded, American officers and enlisted men as well as British patients already wounded up the line.

So much for the peaceful life at a base-hospital subject to the type of warfare the Boche dispenses.

But to return to the *x*-ray hut. John Young has devised the prettiest rapid fire, short-range localizer ever thought of. It has got to be—with a record of one hundred and forty-three localizations in a day after the Vimy Ridge show. He and I use it constantly all day long at our respective hospitals (he is with the British service) and it gives as much satisfaction as could be possible. Young describes it in the Archives for July, I think. If our combined paper passed G. H. Q. without a hitch we'll have it sent to the JOURNAL.

My best wishes are for you all, and we'll all see each other again, if on these highly necessary occasions, I can reach my dugout with sufficient promptitude.

As always, affectionately yours,

PERCY BROWN."

CURRENT ROENTGENOLOGICAL LITERATURE

So thoroughly has the roentgen ray permeated medical literature that roentgenological progress must be traced in the contributions of internists and surgeons no less than in the special work of roentgenologists. The recognition of this fact makes roentgenological reviews and extracts a laborious task of literary research. An article under a surgical or medical title which gives no hint of the roentgen ray may nevertheless be of the highest value to roentgenologists because *x*-ray findings are given in vital relation to clinical, operative or autopsy records.

The culture and efficiency of American roentgenologists depends in large measure on their acquaintance with current roentgenological work as recorded in the medical literature of the world. One of the purposes of the JOURNAL is to supply this necessity in full measure. But this involves problems of coöperation and finance which are yet to be solved. It is to be hoped that a favorable sentiment can be aroused among the members of this society to warrant the enlargement of the JOURNAL after the war.

However, the backbone of the JOURNAL is and must be always the original work done by the members. Reviews and abstracts of what others are doing must be always secondary. Ours must be a Journal which the reviewers of other journals find indispensable. To this end the members should begin at once on work to be embodied in papers and demonstrations for the next annual and midwinter sessions of the society.

One of our editorial board at our urgent solicitation has, under high pressure, given us a rapid survey of the work of the government committees in selecting, inventing and standardizing apparatus, in establishing schools of military roentgenology, and in preparing an official manual of extraordinary merit. This work not only reflects credit on Major Christie as the Departmental Chief but brings into prominence the proficient coöperation of members of this Society.

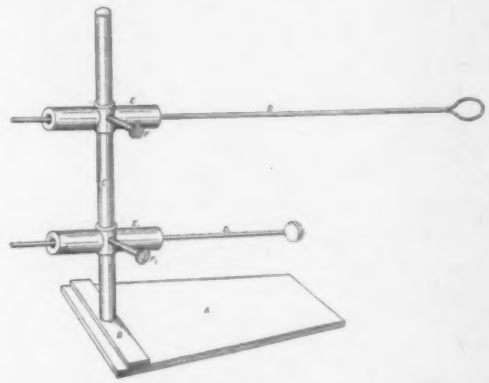
Guided by the experience of our allies, American roentgenologists have been able to avoid many mistakes, and American inventive genius has rarely shown to better advantage than in the evolution and adaptation of roentgenographic apparatus to practical miliary purposes.

The Young's Method of Localization

The method of rapid fire localization mentioned by Captain Percy Brown is credited to Captain John S. Young, M.D., of St. Louis, Missouri, U. S. A. His brief communication is published in the Archives of Radiology and Electrotherapy of July, 1917.

The Young method has been developed under conditions of active service at the front. It has stood the exacting test of handling the deluge of cases which follow after a "big push." It is entirely and necessarily fluoroscopic. Plates cannot be used. Localization is obtained in the two required planes by a truly simple instrument without scales and without computation. The rapidity, accuracy and economy of this method distinguish it from the uncomputed multitude of localizing devices.

The essential part of Captain Young's own description—a model of brevity and clearness—is as follows: "This consists simply of a small apparatus, with an aluminium base, which rests underneath the part which contains the foreign body, and an upright standard which rests upon the broad end of the aluminium base. This standard has two adjustable cuffs—an upper and a lower—through each of which passes a rod. The upper rod has a loop on its end, while the lower has a small metallic ball. These rods are both adjustable in two directions, and are secured by two set-screws.



A, Aluminium Base (underneath patient); B, Support for upright standard; C, Upright standard; D, Rod with loop, locate perpendicular; D_1, Rod with ball, locate base. Right angles to perpendicular; E, Cuff through which perpendicular localizer passes; E_1, Cuff through which horizontal localizer passes; F, Adjusting screw to fasten perpendicular localizer; F_1, Adjusting screw to fasten horizontal localizer.

"The patient is placed upon the aluminium base (tube of course beneath the table), foreign body is located by the central rays, and loop is pressed directly over the same. After having pressed the loop on the upper rod close to the skin so that there will be no motion, the diaphragm is then opened and the tube moved back and forth, and the ball is then adjusted so that it moves in the same plane with the foreign body. The foreign body is thus located in two directions, the ball locating it at the base line and the loop locating it in the perpendicular plane."

TRANSLATIONS & ABSTRACTS

A German Portable Field Roentgen Installation.

The German army is provided with a number of roentgen war automobiles, in which the apparatus and accessories are firmly mounted. Of a different type is a set of two automobiles, consisting of a 30–50 H.P. "Adler" and a 30–45 H.P. "Fiat" car, which have been equipped for roentgen service in the field, thanks to the munificence of a Hamburg merchant. According to this plan, which has been devised and superintended by Dr. F. Haenisch, the well-known past-master of the roentgen art, the apparatus and instruments are not mounted into the cars, but specially constructed or remodeled so as to fit into every available corner and taken out and mounted, whenever required for use. Contrary to the official war cars, therefore, this installation can only be used in connection with base or field hospitals which afford relative safety from interference with treatment and transportation, but it has the advantage of greater efficiency over the official type in that it is equal, within the sphere of its utility, to a small, first-class, modern roentgen institute. The cars, fully equipped, have been amalgamated with the hospital service of Prof. L. Brauer, who acts as a consulting engineer at the Eastern front of the European war troubles, and they have been equipped in the most satisfactory style by R. Seifert & Co. of Hamburg. An illustrated description of these cars in the *Fortschritte auf dem Gebiete der Roentgenstrahlen* for May 20, 1915, shows the elaborate and painstaking thoroughness of the details.

Both cars were originally constructed as ambulances for transportation and treatment of the wounded, furnished with stretchers and instruments. As Haenisch would not on any account be without a heart-measuring device and an orthodiagraph, and since the narrow-slit-diaphragm technic was considered too subtle for use in war, he decided on distant exposure at 1.5 to 2 meters by means of a powerful high tension transformer in spite of its great weight. This required a substantial stand around which the other parts had to be grouped.

The dynamo is operated by the benzine motor. In order to obtain the high energy of 5 kw. for the high tension transformer, a 15 H.P. machine was decided upon, capable of generating 8 to 9 kw. Both are mounted on a cast iron foundation, and the switchboard and governor are attached at the end of the dynamo. The benzine container is screwed on top of the dynamo. The cooling tank is a separate part and is used in transportation for storing the switchboard and a lead box for the dry plates.

The Eresco high tension apparatus (5 kw. at 220 volt direct current) had to be divided into an upper and a lower part for purposes of transportation, the upper part containing the one-anchor transformer with the transformer shaft, and the lower part consisting of two boxes, each of which has a built-in transformer to provide for a reserve apparatus. The boxes have heat and cold insulation to withstand the changes of temperature. The lids of the transformer boxes are arranged to serve as tubeholder boards. There is also a plentiful supply of reserve parts, hard rubber rods, etc.

The lead-plated protective wall with a lead-glass window is hooked into a corner of the box, carrying a detachable instantaneous electric switch. The switchboard is detached and mounted on wheels. In transportation, it is strapped to the upper front part of the box. There are two complete milliamperemeters.

Provision is made for fluoroscopy and roentgenography in the sitting and erect positions, likewise for distant exposures. The latter arrangement, while based on the ordinary types, has been remodeled to admit of dismounting, taking into parts, transportation and conformation to the available space, without suffering in efficiency, precision or stability. Adjustable screws overcome any unevenness of the floor. The protective tube box is suspended and freely movable in all directions. The counterweights are placed in the lateral wood frames and held in position by bolts during transportation. The cord reels at the top are detachable and provided with a bayonet lock. Entirely new devices allow of precise centering of the tube box, admitting of running up and down as well as laterally. The lateral arms for holding the tube may be folded flat during transportation. The manipulation of the diaphragm is effected by means of a movable shaft.

In front of the fluoroscopic apparatus there

are movable rails on which the rotatory chair may be pushed forward up to two meters. The height of the seat is adjustable. The cassette holder is arranged in the usual manner.

A trochoscope, with the box under the table, has been improvised by Haenisch by arranging ball bearings under the legs of the table which can be raised or lowered by means of a fork, so that the table may stand solid on the ground or on casters which run on iron plates. Insulators with transverse rods prevent all danger from the cables.

There is a Forssell's box for the inspection of plates from 13 x 18 to 40 x 50 cm., independent of light or time of day. Everything is packed in square boxes which snugly fill out the interior of the two cars, the details of the distribution of the outfit being fully described in Haenisch's article. The boxes themselves are so constructed as to be serviceable for tables or shelves.

The installation, according to Haenisch's statement, answers nearly all requirements of modern surgical and internal roentgenology—from a short skeleton exposure to half-second instantaneous work and distant (2-meter) exposures of the heart. All the directions of the rays are provided for.

The Osseous Dystrophies Simulating Bone Tumors.

When Virchow, in 1877, systematically opened all the long bones of an aged woman who had died from diffuse lymphosarcoma and found in the right humerus a cyst the size of a large walnut which he considered due to the breaking down of a cartilaginous metastasis, he promulgated the theory of neoplastic origin of simple bone cysts. His observations attracted slight notice at that time, and but little attention was paid to these lesions until the development of the *x*-ray led to their occasional recognition in the attempt to differentiate the various bone lesions. When operative statistics as well as autopsy findings and studies of their histological structure began to appear in the literature, it was found that many of these bone cysts did not at all conform to the neoplastic idea advanced by Virchow. Abroad, the reports of von Recklinghausen, Renn, Mikulicz, Mauclaire, and others; in America, the studies of Bloodgood, the late Carl Beck, Barrie, and others have brought this type of bone lesion adequately before the surgeon, from the standpoint of both the diagnostician and the pathologist; so that now the progressive surgeon and the expert roentgenologist are on the lookout for simple bone cysts, especially in cases of spontaneous fracture in early life, as well as for tumors of a malignant nature.

The most recent contribution to this subject is that of Berard and Almartine in the *Revue de Chirurgie* for August, 1914–November, 1915. They report three personal cases and a résumé from the literature of twenty-five others which they considered to conform to the type (fibrocystic osteodystrophy) which they discuss in their paper. By way of introduction they first remind the reader that there occur in certain of the long bones—sometimes in the epiphysis, sometimes in the diaphysis—localized dystrophic lesions entirely independent of any neoplastic process, which are capable of simulating, clinically, tumors of the bone, and that these lesions are well known to-day, thanks to roentgenography and to the sufficiently numerous surgical interventions to which they have given rise. According to the anatomico-pathological form which they take on, they have been variously called simple cysts of the bone, spongy callus, fibrocystic osteodystrophies, but the authors believe these form only a single group, "pseudotumors of bone by osteodystrophy."

In considering the etiology, the authors point out that the age of the patients varies within narrow limits and that the malady is one of the period of growth. They find that but rarely does the age exceed thirty, and that if, in these latter cases, one examines minutely into the previous history, one usually finds that the affection is of long standing and dates from adolescence; in this they agree with Mikulicz. In the anamnesis of these patients one does not generally bring out a history of any previous osseous affection such as rickets, osteomyelitis, tuberculosis, or syphilis. By far the most prominent among etiological factors is the history of traumatism. This would seem to be shown by the fact that of eighty-four observations of bone cysts collected by J. Mutel, in twenty-four there had been one or more previous fractures and in twenty-six there was a definite history of one or many previous contusions, and eliminating the cases in the literature where the history was lacking, Mutel

found that of sixty-three cases forty-seven, or about 80 per cent., followed contusion or fracture. Berard and Almartine, however, hold that traumatism as a causal factor is not always demonstrated, and that often it merely brings about examination by the surgeon which then reveals the presence of an already existing lesion.

There are four principal theories as to the pathogenesis of these cysts, namely, the neoplastic, the infectious, the traumatic and the trophic. The authors discard the first two of these as based on errors of diagnosis or misinterpretation of findings, while their convictions as to the insufficiency of the traumatic theory have already been alluded to. Of the trophic theory they say that the histological characteristics of the lesions found compel adherence to it. In support of this they call attention to numerous facts, one of which is that these cysts are found near the epiphysis or the center of the diaphysis, and they state in explanation that at the level of the epiphysis the arterioles have the character of terminal vessels and that the nourishment of the bone is equally precarious at the middle portion of the diaphysis, while they also consider that functional trouble in the glands of internal secretion which influence bone growth have to be taken into account, as seemed apparent in one of their personal cases.

As to treatment, we find that the most frequent intervention has been opening of the cyst and curreting its walls, packing, and wound healing by granulation. In some cases the periosteum and soft parts have been turned down and the cyst space obliterated by organization of blood clot or filled with Mosetig-Moorhof wax. These two types of operation apply more especially to the cases in which the cysts have been relatively small. For the more extensive cases with voluminous cysts, and for those with almost complete destruction of the continuity of the shaft, numerous operative procedures have been employed, including in recent years, the transplantation of a portion of the clavicle (Delanglade), the fibula (Lexer), and the tibia, after resection of the diseased area. Since these lesions are non-malignant, the treatment should be as conservative as possible.

Upon the basis of their extensive study of the question the authors feel that the following conclusions are justified: "There occur in certain long bones of the extremities, sometimes in the juxta-epiphyseal region, sometimes in middiaphysis, certain dystrophic lesions capable of simulating, clinically, tumors of the bone. These lesions are met with in the anatomical form of a fibrocystic osteitis of central origin; they may take on rather variable microscopic appearances (solitary cyst of the bone, spongy callus, fibrocystic pseudotumors). These lesions are neither inflammatory nor neoplastic. They result from a derangement in the nutrition of the bone. The cause of this derangement is rather difficult to determine. The influence of traumatism has often been imputed. Insufficiency of the glands of internal secretion which regulate the nutrition of osseous tissue, notably the thyroid, likewise seems an etiologic factor. Taking advantage of the clinical history of the patient and the roentgenographic findings, it is possible, if not to be certain of the diagnosis, at least to suspect it and avoid confusion with an osseous tumor. The interest in this diagnosis is considerable, the prognosis and the therapeusis being essentially different in the two cases. These lesions in fact are of a benign nature and essentially curable. The intervention will consist in as conservative an operation as possible. . . . Recurrences never take place and the functional results are excellent, at least whenever the extent of the lesions has not rendered considerable osseous removal necessary, which is exceptional."

We have given a somewhat extended review of Berard and Almartine's article, since the subject should be of very considerable interest to the surgeon and is one that has received adequate attention by comparatively few in this country. We have presented a review uncolored by our own theories or opinions; but we shall be surprised if some of the views expressed by them go long unchallenged.—*Med. Rec.* (Apr. 29, 1916).

MOORE, ALEXANDER B. The Roentgen Diagnosis of Non-Tuberculous Diseases of the Lungs. (*Journ.-Lancet*, July 1, 1917, p. 430.)

From his experience gained in the Mayo Clinic the author states that probably the best and at the same time simplest classification of non-tuberculous pulmonary lesions is to distinguish between malignant and inflammatory

conditions and to subdivide the malignant class into primary and secondary.

Primary malignancy occurs in three forms: the infiltrative, the miliary, and the mixed. The infiltrative form is indicated by a massive shadow around the roots of the hilum and is usually located on one side. The miliary form has multiple discrete areas of increased density extending through both lungs. The mixed form resembles both and is the commonest. Primary malignancy is distinguished from inflammatory conditions by the absence of a surrounding zone of inflammatory reaction and by the absence of a cavity-like appearance.

Secondary malignancy has been observed by the author in the lungs, breast, thyroid, kidney, extremities, lips, testes, bowels and stomach. A definite roentgen diagnosis was made in 58 out of 71 cases, and a probable diagnosis in 12 with a personal error in one case. The secondary carcinomas appear roentgenologically as clearly circumscribed nodules without any inflammatory walls and without the fimbriated edges characteristic of lung abscess. They are usually multiple and situated near the bases of the pulmonary lobes and show no tendency to cavitation.

The most important non-tuberculous inflammatory conditions are bronchitis, bronchiectasis and lung abscess. Bronchitis gives a fine, string-like shadow along the course of the main bronchi, radiating outward from the hilum without reaching the periphery of the chest and varying in density according to the congestion present.

Moore distinguishes between three roentgen types of bronchitis: the infiltrative, the cylindrical, and the sacculated. The infiltrative type shows an increase in density, usually in the lower lobes, the shadows extending to the periphery of the chest and usually obliterating the costophrenic angle. In the cylindrical type, which is similar, small pseudo-cavitations are present. The sacculated type is characterized by multiple large pseudo-cavitations, separated by very dense fibrous tissue. Lung abscess appears as a large area of increased density when filled, or as an area of decreased density when empty. The characteristic fluid level of a partly empty cavity is often observed.

An abscess differs from a tumor roentgenologically in the surrounding inflammatory zone, and from tuberculosis by its greater size and its location.

Petit and Aubourg. Displacement of Foreign Body During Operation. (*Paris Médical*, July 7, 1917, p. 44.)

After a shrapnel had been located in the chest of a soldier, it was found necessary during the attempted surgical removal to resect a rib. This procedure caused the foreign body to slip and fall into the pleural cavity. A second roentgen examination became necessary, by which the shrapnel was located in the anterior mediastinal cul-de-sac. Based upon this experience the authors demand that all similar surgical procedures should be carried out under the guidance of the screen, so as to avoid a perfectly unnecessary prolongation of the surgical intervention.

Keefe, John W. The Advantages of Conservative Surgery in Operations for Diverticulitis of the Descending and Pelvic Colon. (*Boston Med. and Surg. Jour.*, Feb. 22, 1917, p. 271.)

In the course of his analytical examination into the advantages of conservative surgery in diverticulitis of the colon, Keefe states that in the differentiation of this condition from carcinoma a proçtoscopic examination is of no value, except in the rare cases in which intussusception has occurred into the rectum. The greatest aid in this difficulty is afforded by roentgenology, and the findings where a diverticulosis is present are described by the author as follows:

Small rounded shadows are seen in the affected areas, these being the residue of the opaque salts retained in the diverticula. This filling defect resembles very much that occurring in cases of carcinoma. The identifying feature is the fact that in the case of diverticula the shadows always appear in groups, and constantly maintain the same relation to each other, which is not the case when carcinoma is present. They are best seen on the second and third day and generally show to better advantage after a barium enema.

Ureteral stones, phleboliths and calcified glands produce shadows almost indistinguishable from those of barium-filled diverticula. These shadows, however, can be differentiated in the following way: during a screen examination palpate over the mass and, if a diverticulum be present, the barium-filled area will

move with the bowel which, of course, is not the case with ureteral stones, phleboliths or calcified glands. This method of differentiation is applicable only in cases in which the upper sigmoid is involved, inasmuch as the lower sigmoid can not be shifted by palpation. In the latter case, it is necessary to make a plate or screen examination before the enema is given. The antero-posterior view is usually the best on account of the frequency with which diverticula occur at the mesenteric border of the bowel, but as there is considerable variation in the site of their occurrence, it is well to resort to stereoscopic roentgenograms and to make screen and plate examinations at various angles of observation. The liquid enema, introduced under some pressure, has been found to be more satisfactory than the opaque meal, since it is more likely to fill the diverticulum, while the opaque meal usually scatters more or less through the bowel.

In a general way it may be said that the success or failure of a roentgen examination in a case of diverticulosis depends on two factors: (1) whether the diverticulum is filled with a fecal concretion which might preclude the possibility of the entrance of the barium, and (2) whether the inlet to the diverticulum is stenosed, since cases have occurred in which stenosis had progressed to such a degree that the liquid enema was prevented from entering.

VITAL, AZA D. Foreign Body in the Peritoneal Cavity. (*Progreso Clinico*, Madrid, 1917, Vol. V, p. 76. Ref. *Intern. Abstr. of Surg.*, August, 1917, p. 129.)

In a woman of 36 with chronic abdominal pains, who had been given various medical treatments without relief, a roentgen examination was absolutely negative. On coming to the author, careful palpation showed a small movable tumor in the umbilical region. The symptoms appeared to suggest a diagnosis of suppurative ovarian cyst. On laparotomy, several loops of intestine were found intimately fused with the large omentum, forming a mass adherent to the parietal peritoneum and abdominal walls. In the midst of this mass a blackish portion was found which on examination was found to contain a small encysted piece of metal. The author thinks that this having been swallowed, perforated the anterior stomach wall and lodged in the large omentum which, on inflammatory reaction, encysted it and, becoming adherent to the parietal wall, ultimately formed the tumor mass felt on palpation. A similar case was reported by Nagy in 1914.

The author points out that the roentgen rays do not always solve problems of this kind, although they are apparently simple enough to diagnose, as in the case reported. The metal would have shown on a good plate.

CORLETTE, C. E. Left-Sided Cecum and Ascending Colon with Absence of Transverse Colon. (*Med. Jour. Australia*, June 30, 1917; Ref. *Jour. Am. Med. Assoc.*, Aug. 18, 1917, p. 594.)

A man, 30 years of age, had for years complained of various gastric symptoms and of constipation, notably flatulence after meals. At times he had pain and excessive discomfort, relieved by washing out the stomach. The roentgen ray disclosed a peculiar abnormality of the intestine. The cecum and ascending colon were to the left of the midline and ascended almost vertically to the splenic flexure, there being an absence of a good deal of colon.

COMBE, A. Roentgen Therapy in Tuberculosis in Infants. (*Le Nourrisson*, Paris, Vol. V, No. 1. Ref. *Jour. Am. Med. Assoc.*, June 2, 1917, p. 1668.)

Combe (whose death was recently announced) states that his experience with roentgen treatment of tuberculosis in infants was still in a tentative stage, but the results were encouraging with tuberculous glands and tuberculous osteitis. One infant with tuberculous peritonitis and a tuberculous process in the apex had the apical lesion exposed to the roentgen rays three times at eight-day intervals. Necropsy showed the apical lesion arrested and practically walled in, but the thymus was atrophied. If the roentgen rays are responsible for the atrophy of the thymus, roentgen treatment in this form is contraindicated for infants.

COHN, I. Sprains. (*N. Orl. Med. and Surg. Jour.*, 1917, p. 627. Ref. *Internat. Abstr. of Surg.*, August, 1917, p. 131.)

The term sprain is used to denote a joint wrench due to sudden twist or traction, the ligaments being more or less damaged. But

most often the true pathology in a case diagnosed as sprain is that of fracture or luxation, or both. Some authors even deny the existence of pure sprain but believe a sprain always a fracture, but Cohn states that in a large proportion of cases sprains are complicated by fractures, and cites five cases of "sprains" of the knee, ankle, and shoulder, that showed fracture by the roentgen ray. Most sprains of the wrist show fracture of the carpal bone. Sprains are infrequent as compared with other injuries about joints, and all other injuries should be ruled out before a diagnosis of sprain is made.

DELAVAN, D. BRYSON. Radium in Carcinoma of the Upper Air Passages. (*Med. Rec.*, June 30, 1917, p. 1130.)

The Memorial Hospital of New York possesses three grams of radium metal, and during the last three years 422 cases were treated by means of them, 184 of which involved the upper air passages. In the above article Dr. Bryan reviews the latter and comes to the conclusion that by far the best results are gained by the prompt treatment of early cases, and the question in his opinion is how long it will be before radium, acting as successfully as it does in the early cases, will be conceded worthy to supplant surgery.

The details of the results attained may be summarized as follows:

Of 25 cases of carcinoma of the lips there was complete retrogression in 6, all of which were in an early stage. Twelve were unimproved. Three cases of the nasal mucosa were treated. In that location radium treatment is very difficult, but in one of the cases removal of the growths which occluded both nasal passages with a snare and treatment of the bases with radium gave excellent results.

Of 27 cases of epidermoid carcinoma of the superior maxilla 4 underwent a retrogression clinically complete, and 11 were considerably improved. Four cases out of 7 of epithelioma of the cheek completely retrogressed and are to-day well, one of them for over 2 years. Of 12 patients with carcinoma of the inferior maxilla 5 have been improved, while the others are considerably improving. The floor of the mouth was treated in 6 instances, 4 being improved.

The results in the treatment of cancer of the soft palate, tonsils and pharynx are considered gratifying in view of the fact that cancer of that region is not easy of surgical cure. Of 26 cases of cancer of the tonsils 5 completely retrogressed; of 50 tongue cases 2 were cured for more than a year and are still well, while 24 were unimproved. The comparatively large percentage of slight or no improvement is attributed to the vascularity and activity of the tongue, the abundance of neighboring lymph nodes and the peculiar difficulties in the way of applying the radium in that locality. This disappointing record also emphasizes the malignancy of cancer of the tongue. Complete retrogression in cancer of the larynx took place in 4 out of 27 cases, but 3 of these died later from recurrence.

The author thinks that enough has been accomplished in these three years to offer abundant encouragement for the present and brilliant hopes for the future.

BAZY. Extraction of Projectiles in the Lung. (*Bull. de l'Academie de médecine*, Paris, April 17, 1917. Ref. *Jour. Am. Med. Assoc.*, June 2, 1917, p. 1668.)

Bazy describes the method with which Petit de la Villéon removes a projectile in the lung, the whole procedure complete in a minute or two. He works in red light, guided by the roentgen rays. After marking on the skin the point of the shadow of the projectile, he incises the skin two or three fingerbreadths to one side of the shadow, and then pushes into the depths a special forceps and seizes the projectile, guided by the shadows of the projectile and of the forceps as they approach each other. The lung is remarkably tolerant and the small accumulation of blood along the track of the forceps is speedily absorbed as is evidenced by roentgenoscopy, but there may be a little blood in the sputum for a month. Bazy warns that this technic is not applicable for projectiles in the hilus region, nor when an abscess has formed around the projectile or there is more than one foreign body.

BISSELL, FRANK S. The Early Roentgen Diagnosis of Pulmonary Tuberculosis. (*Jour.-Lancet*, July 1, 1917, p. 431.)

In a grand total of 988 cases, in which stereoroentgenograms of the lungs have been examined by the author since November, 1911,

an attempt has been made to correlate the clinical evidence with the roentgen diagnosis. This has been difficult in a large number of cases and impossible in many, since some of them were dispensary cases who are prone to drift. The few cases which come to autopsy are the least interesting ones, since they belong to the advanced type in which terminal changes have obliterated the earlier ones. In drawing conclusions from this series of cases, therefore, it seems better to generalize than to attempt any statistical deductions.

The cases which are most amenable to physical diagnosis, those with primary development of the pleura, are most likely to baffle the roentgenologist. At times the roentgenogram appears perfectly normal, while at others there is only the slight diffuse density over an apex of one lobe, due to the pleuritic cap. On the other hand, those cases which offer the most unmistakable signs, deep in the parenchyma of the lung, frequently escape detection by other means. Activity is often determined more definitely by symptoms and physical signs than by roentgen signs, but the latter are of great assistance in such cases affording, as they do, an objective stimulus to the efforts of the diagnostician. The disease may be so slowly progressive that it heals in one area of the lung as it develops in another, thus continuing through life to handicap the host without reaching an advanced stage or producing classical symptoms.

The author appends the history of 4 specific cases as serving to illustrate the practical value of the roentgen method when properly employed, as well as to differentiate various types of the disease.

LIABILITY FOR ROENTGEN BURN.—(HOLT vs. TEN BROECK (Minn.), 159 N.W.R. 1073.)

The Supreme Court of Minnesota affirms a judgment for $2,500 damages in favor of the plaintiff for injury from a burn alleged to have been caused by the negligence of the defendant in making a roentgenogram. The court says that in February, 1915, the plaintiff was under treatment for some trouble in her hip supposed to be a fracture or a dislocation. Her attending physician desired a roentgenogram. The defendant, a regularly licensed physician, took it. A few weeks afterward a sore developed on the plaintiff's hip which it was claimed was the result of a roentgen burn. The evidence was sufficient to sustain a finding that the roentgen ray caused the sore. The testimony of the plaintiff was that there was none before. It was at the point of the exposure. There was medical testimony having a tendency to prove that it came from a roentgen burn. The question was for the jury. To recover damages it was necessary that the plaintiff prove negligence in the defendant. There was little direct evidence of negligence. The plaintiff claimed that during the progress of the taking the defendant made some exclamation to the effect that the machine was not working right. Her claim was that the exposure was unduly long, but her testimony did not strongly support it. A physician sufficiently qualified to give an opinion as an expert stated that a proper application of the rays would not produce the result which he found. The evidence was that with a proper machine and with a proper use of it a burn is unusual. There was evidence that the machine was a proper one. The machine and its operation were wholly under the control of the defendant. Under such circumstances the rule of *res ipsa loquitur* (the matter speaks for itself) applies. It did not follow from this, as the plaintiff's counsel argued, that the burden shifted to the defendant of proving freedom from negligence. "*Res ipsa loquitur*, where it applies, does not convert the defendant's general issue into an affirmative defense." The language quoted was approved in a case in which this court held that the *res ipsa loquitur* rule merely permits the jury to draw an inference of negligence, and "the jury is to consider and weigh the inference, in the light of all the facts and circumstances, and give it such weight as tending to prove negligence as they deem it entitled to." It does not follow from what is here said that the *res ipsa loquitur* doctrine applies to a bad result or mishap coming from a physician's treatment. The rule does not apply in such cases. In determining negligence it can make no difference whether the one operating the roentgenographic appliance is a physician or a lay expert. The care required is ordinary care. It is the care exercised by and to be expected from one reasonably skilled in the use of the appliance. The rays were not applied for curative purposes, but to obtain information. This is the logical if not the necessary result of the holding in *Henslin vs. Wheaton*. 91 Minn. 219, 97 N.W.R. 882, that

in an action against a physician for negligence in the use of a roentgenographic machine he was not entitled to have the question of his skill determined by physicians of his own school. A physician who qualified himself as an expert in the application of the roentgen ray was permitted to give his opinion, based on the result of the operation, that the application was improper. This was not error. The verdict was for $2,500. The defendant claimed that it was excessive. The trial occurred a year after the injury. After the injury developed, the plaintiff wandered from doctor to doctor for several months. Finally she went to the hospital. She was there 6 months. The pain had been considerable. At the time of the trial, so her claim was, she was unable to work. The sore was still open and of considerable extent. One physician said it was uncertain whether it would be permanent. The verdict was not excessive. (*Jour. Am. Med. Assoc.* June 23, 1917, p. 1938.)

In ufficient Evidence of Malpractice in Treatment of Fracture.—(Snearly *vs.* McCarthy (Ia.), 161 N.W.R. 108.)—The supreme Court of Iowa affirms a judgment in favor of the defendant, who was sued for damages for alleged malpractice in the treatment of a simple oblique fracture of the femur of the plaintiff's right leg.

The following part of the judgment is of interest to roentgenologists.

It was claimed that the defendant was negligent in not using the roentgen ray before he did anything toward reducing the fracture, but the testimony showed hat it is entirely optional with physicians and surgeons whether to use the roentgen ray or not in the first instance. The purpose, of course, in using it is to diagnose the case, and if this may properly be done without the use of this modern appliance, then no negligence is to be inferred from failure to use it. Moreover, the record here showed that the nature of the fracture was discovered when the defendant was first called; hence a roentgen ray examination would have added nothing. (*Jour. Am. Med. Assoc.*, Aug. 4, 1917, p. 403.)

Bissell, Joseph B. Radium Dosage. (*Medical Record*, Vol. 91, No. 17, April 28, 1917, p. 720.)

The following is the author's summary:

1. Up to the present time in spite of the fact that so much has been written concerning the use of radium in cancer, very few data are available regarding the proper dosage.

2. Massive, intensive and long-time applications are necessary for the treatment of malignant disease.

3. These heavy doses may produce conditions of toxemia and faulty metabolism conducive to an unfavorable outcome.

4. Radium acts best in close proximity to the tissue it is desired to affect. The intensity of its action is diminished as the distance between the radium and the tissue is increased; the effect varies inversely as to the square of the distance.

5. The first application is a tentative one as to both time and amount.

6. Crossfiring is the most satisfactory way of application.

7. Burning of the surface tissues may be entirely unavoidable.

8. The more complete the removal of the malignant mass by operation or other instrumentalities the more favorable is the chance of success by radium treatment.

9. For histological, pathological, chemical and physical reasons radium sufficient to absorb and destroy cancerous masses must be applied repeatedly and in large doses at various intervals; the length of the intervals depending upon the situation, the size, the type and the stage of the disease as well as upon the local and general condition of the patient.

Young, H. H. Use of Radium and Punch Operation in Desperate Cases of Enlarged Prostate. (*Ann. Surg.*, May, 1917. Ref. *Jour. Am. Med. Assoc.*, Vol. LXVIII, No. 22, June 2, 1917, p. 1662.)

Young's report serves to show that with radium the hypertrophied prostate may be made to atrophy so that a minor operation will suffice to restore normal urination. The long duration of treatment, however, suggests that it be confined to cases with severe complicating conditions which preclude perineal prostatectomy.

Hinman, Frank. Early Diagnosis of Renal Tumor. (*Surg., Gyn. and Obst.*, Vol. XXIV, No. 6, June, 1917, p. 669.)

The effort in every cancer problem is to make a diagnosis early enough. Surgeons can not cure renal tumor in the face of generalized

metastases, and the various histological forms of malignant tumors of the kidney parenchyma do not, as a rule, permit of clinical differentiation.

Roentgen exploration is seldom of much value in these cases unless associated with pyelography. But plain roentgenograms may show shadows in the kidney region or line of the ureter and their advantage is to cause special procedures to be used in the cystoscopic examination which otherwise might be neglected. The finding of stone in the kidney does not eliminate the possibility of tumor, as cases are on record where both conditions were present. In one of the author's cases, which he communicates, stones were shown by the roentgen ray on the opposite side, and a very much injured kidney containing multiple stones with a unipolar sarcoma of the other kidney found after death from uremia. The roentgen examination may show differences in size of kidney shadows and has a considerable value in locating bone and lung metastases.

TODYO, TSUNEHARU. The Growth of Free Bone Transplants. (*Surg., Gyn. and Obst.*, Vol. XXIV, No. 6, June, 1917, p. 701.)

Ollier's view that bone transplanted with its periosteum can survive, was overthrown when Barth advocated that, according to his experiments, transplanted bone entirely loses its vital power and is replaced by newly built bone tissue.

Dr. Tsuneharu Todyo, instructor in the Orthopedic Clinic of the Imperial University of Kiushiu, Japan, has fallen back on the aid of roentgenography to settle the matter and now publishes the result of extensive animal experiments, illustrated by 15 roentgenograms, from which he draws the conclusion, among others, that the bone with its periosteum, if transplanted in the same body under favorable conditions, continues to live.

ROENTGENOGRAPHIC PLATES ALONE NOT EVIDENCE. (*Jour. Am. Med. Assoc.*, Vol. LXVIII, No. 19, May 12, 1917, p. 1433.)

The Supreme Court of Oklahoma reverses a judgment obtained by plaintiff Fisher for personal injuries, on account of error in the admission of evidence of certain roentgenographic plates tending to prove the existence of certain physical defects in and about the bony structure of his head. The evidence afforded to identify the plates was given by a physician who testified that from an examination of the plaintiff, based on symptoms related to him, he was unable to find the cause of plaintiff's trouble, and sent him to another physician to have a roentgenographic plate made, and that he was not present when the plates were made. The witness further testified that this evidence, relative to the plaintiff's injuries, was based on the information divulged by these plates. The expert who made the plates did not testify, nor did any one who was present at the time the plates were made. The court said that the plates were not admissible in evidence, nor could they be until they were properly identified or shown to have been made by trustworthy instruments properly used by a person skilled in making, reading and interpreting such plates, and further shown to be correct representations of the bony structure of the plaintiff's head. The admission of roentgenographic plates in evidence rests fundamentally on the theory that they are the pictorial communication of a qualified witness who uses this method of conveying to the jury a reproduction of the object of which he is testifying; this being true, the roentgenographic plates must be made a part of the testimony of some qualified witness, and the witness should qualify himself by showing that the process is known to himself to give correct representations, and that it is a true representation of such object. (Bartelsville Zinc Co. vs. Fisher, 159 Pac. R. 476.)

BOOK REVIEWS

THE MEDICAL CLINICS OF AMERICA, Vol. I, No. 1. Johns Hopkins Number. Publ. Bimonthly by W. B. Saunders Company. Octavo, 200 Pages, 14 Illustrations. Price per year, $10.00.

This is a new venture by the Saunders Company, consisting of reports upon various well-known medical clinics in America, and it is a worthwhile publication. Probably now the literary deluge will compel the physician to take advantage of his vacation period to catch up with his clinic reading instead of devoting it to the time-honored clinic attendance. This method of post-graduate teaching is only a forerunner to the motion picture which is about to invade the county medical society.

There are six medical clinics recorded in this issue. Such Hopkins men as Janeway, Barker, Hamman, Brown, Mosenthal and Futcher discuss a number of prosaic problems in medicine. Necessarily any medical clinic report is comparatively dull, lacking as it does the brilliant illustrations of surgical reports. They are wonderfully erudite but failing in eclat. Medical literature for the average practitioner requires a rare charm of style to compete with the allurements of surgical illustrations, charts and roentgenograms.

We find Janeway adopting the dialogue style of presentation in a case of Hodgkin's disease. Barker also uses this colloquial style to impress his views of meningitis upon his readers.

There appears much of interest to the internist but very little to the roentgenologist in this first issue, although a clinic by Pancoast is announced to appear in the next issue, the "Philadelphia Number." To be sure, this is a "Medical Clinics," but the publishers would do well to consider the roentgen field if they are to derive support therefrom. There are many spots in this first issue which could well have borne the illuminating sidelight of a roentgenological discussion.

It would seem that these medical clinics are a little forced. Is there a great demand for such *table d'hôte* medical literature? The ephemeral journal takes care of just the same field. Probably such readable clinics as the one under review will force eminent clinicians to work a little harder, and this would be an adequate excuse for their continuance.

E. H. S.

THE SURGICAL CLINICS OF CHICAGO. Vol. I, No. 3, June, 1917. Octavo, 231 Pages and 70 Illustrations. Published by W. B. Saunders Company. Bimonthly. Price per year: Paper, $10.00; Cloth, $14.00.

The third number of the first volume of the Chicago Surgical Clinics greets the roentgenologist in a most hospitable manner. Our attention is principally directed to a "Comparison to the Operative and Radiotherapeutic treatment of Uterine Myomas," by Dr. James T. Case. This discussion is quite complete. If we may suggest an amplification for a future contribution to deal with, it would be a comparison of the results in large clinics and the details of the technic employed, as there seems to be a great deal of variation in the therapeutic methods pursued among successful roentgenologists.

There is also a brief description of "Radiotherapy in the After-Treatment of Carcinoma Uteri," by Dr. Henry Schmitz, which is worth attentive perusal.

E. H. S.

THE CONTROL OF HUNGER IN HEALTH AND DISEASE. By ANTON JULIUS CARLSON, Professor of Physiology in the University of Chicago. The University of Chicago Press, Chicago, Ill. 1916. Price $2.00 net.

This book contains a summary of the work on the stomach with special reference to hunger and appetite, which was carried out in the Hull Physiological Laboratory at the University of Chicago during the last four years.

This intensive study by Carlson promises to possess as much in clinical values as Cannon's studies in movements of the gastro-intestinal tract. All roentgenologists should be aware of the great influence of Cannon's studies in the development of abdominal roentgenology both in America and upon the Continent.

Carlson presages important advantages to the cooperative work of the clinical and biological laboratory upon hunger control, because "in these times of plenty, overfeeding, with its physiological penalties and economic waste, is on the whole more prevalent than undernutrition, because of the barbaric indulgence in the pleasures of the table in the absence of the physical stress of a more primitive social condition."

Almost a century ago Beaumont attended a patient at Fort Macinac who developed an external gastric fistula which permitted the study of digestion. The published results of Beaumont furnished the basis of a great deal of the knowledge upon the human gastric digestion over a long period of time. Now comes another similar patient crossing the path of a modern physiologist who proceeds to the experiments which have resulted in this volume on Hunger and Pain.

How different the experiments upon the two similarly deformed patients! Consider Alexis St. Martin and Beaumont amid their simple surroundings at a western fort (Beaumont was an army surgeon) and then leap eighty-five years to the most modern of physiological laboratories a wealthy western university. The contrast is interesting from the standpoint of equipment for study; and to intensify the contrast, let us note that early simple experiments of Beaumont were directed toward the digestion of foods when food materials were simple and not predigested, while Carlson is principally concerned with hunger and pain when foods are anything but simple. Now-a-days our foods are sometimes adulterated, bifurcated, complicated, diluted, predigested and scarce. No wonder they produce hunger and pain.

But to emerge from this unwarranted tangle, the reviewer acknowledges that there is a great deal of useful information which will be gradually applied to gastric practice. But it will be a long time, perhaps a matter of years, before knowledge of this experimental kind will have been adapted to the needs of the general practitioner.

But Carlson's monograph takes its place along with Hilton upon Rest and Pain, Cannon's Mechanical Factors of Digestion or Gray's Anatomy; so it behooves one to procure a first edition to place upon the shelf for posterity. E. H. S.

CANCER, ITS CAUSE AND TREATMENT. By L. DUNCAN BULKLEY, A.M., M.D., Senior Physician to the New York Skin and Cancer Hospital, etc. 282 pages. Price $1.50. Paul B. Hoeber, Publisher, New York, 1917.

Perhaps in no other subject is the roentgenologist so interested as in the cause and treatment of cancer. The statistical portion of the book under review is highly interesting. The chapters on inoperable and recurrent carcinoma might be advantageously added to by a consideration of such roentgenological results as have been achieved by Pfahler and several others.

On p. 52 the author states: "The occurrence of epithelioma as a direct result of repeated and protracted exposure to *x*-ray is familiar to all, and is particularly interesting because it occurs commonly among younger persons, and at a time of life when epithelioma is rare; and especially also because the *x*-ray is constantly effective in curing epithelioma. The rarity of epithelioma resulting from *x*-ray, considering the enormous amount of exposure which must have occurred in making and using *x*-ray tubes, implies, however, that there must be some other cause also at work. It has been urged, therefore, that the skin tissue being altered and weakened from repeated and protracted exposure to *x*-rays, more readily falls prey to some of the chemical or other irritating agencies which have been observed to be followed by epithelioma." This is practically the only reference to the roentgen rays the book contains, and in this reference it is not quite clear to what enormous amount of exposure the author refers "in making *x*-ray tubes."

In a clinical respect the book reflects the great experience the author has gathered on the subject of cancer.